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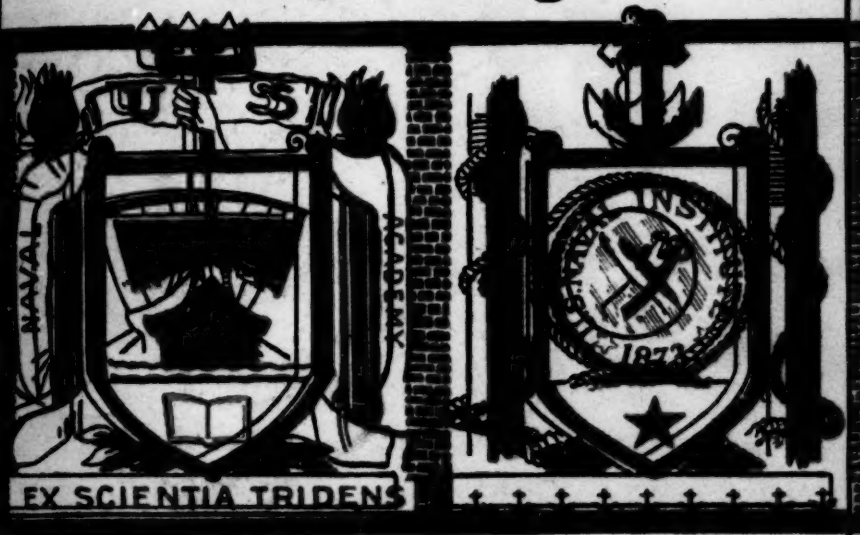

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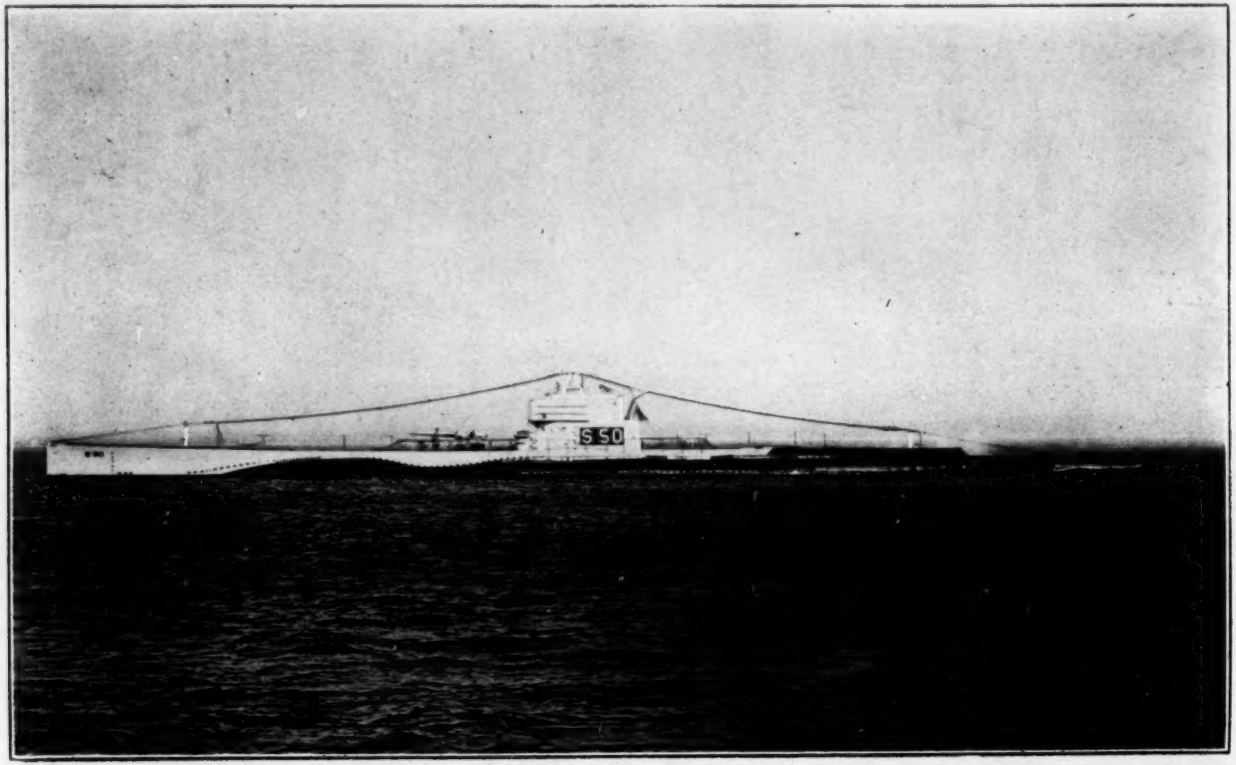

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THE AFFAIR OF THE BLANCHE
(October 7, 1862)

AN INCIDENT OF THE CIVIL WAR

BY REAR ADMIRAL ALBERT GLEAVES, U. S. NAVY

After the proclamation of the blockade by President Lincoln, the navy was charged with the duty of maintaining it, and for this purpose the fleet was divided between the Atlantic and the Gulf coasts.

In the first part of the war blockade running was generally done by small sailing vessels running between the Capes of Virginia and the Rio Grande but these were soon driven off the sea by the Federal cruisers, and their places were taken by steam vessels built for the purpose either in England or Scotland. They were light draft vessels of about 500 tons displacement, and considerable speed.

As a rule they were manned largely by Englishmen, and often were commanded by English naval officers who obtained leave of absence for the purpose, and who sailed under assumed names. The risk and adventure and the chance of easy fortune attracted many bold spirits into the service, and blockade running soon was reduced to a science. The compensation for officers and men was large; the captain's pay for one voyage was about $5,000, the pilot received $3,750, officers were paid from $750 to $2,500 and the crew's wages were $250; besides this all hands had ample op-

portunities for speculations of their own. Cotton that was worth 40 cents a pound in Texas sold for $10 in England. The runners loaded with munitions of war, medicines, clothing, etc., in England, and returned with cargoes of cotton valued at $150,000 to $200,000.* Each voyage was a get-rich-quick adventure.

After the coastwise traffic was broken up, the Bermudas and Bahamas became the points of arrival of the vessels from across the Atlantic, and thence to Wilmington, Charleston, Savannah, and St. Augustine on the Atlantic coast, and Havana and Matamoras in the Gulf.

The blockade runners not only kept the navy occupied, but they also gave the diplomats and international lawyers much to discuss, and there were several affairs which brought the United States to the verge of war with more than one European power. This article deals with one of the most celebrated cases which might have involved us in war both with England and Spain.

It is the story of the United States cruiser *Montgomery*, commanded by Commander Charles Hunter, U. S. Navy, and the destruction of the Confederate steamer *General Rusk*, afterwards renamed the *Blanche*. While in the Confederate service she had entered Havana under the Confederate flag, but at the English consulate she was given up to an English subject, who documented her at that consulate, after which she sailed under English colors. The *Blanche* was one of the boldest and most audacious of the runners. During her career she had run the blockade six times, and Admiral Farragut was anxious for her capture. She ran between Matamoras and Havana, and time and time again she had escaped capture by slipping in behind the reefs, which mark the western end of Cuba, and keeping within the neutral zone of Cuba. She was a two-masted iron side-wheeler of 500 tons, with a walking-beam engine, painted black, and drew about seven and a half feet of water.

Hunter was a well-known, dashing officer who had entered the navy in the early thirties, but owing to ill health, he had retired from the service several years before the war, and was living in Newport when the war broke out. His residence on Kay Street was only a door or so from that of Mrs. James Lawrence, the aged widow of the hero of the *Chesapeake*. Hunter was a favor-

**The Blockade and the Cruisers,* Soley, Scribner's.

ite of Mrs. Lawrence, and when the news came that Fort Sumter had been fired upon, Hunter rushed in to tell her that he was leaving immediately for Washington to ask to be put back on active duty. He said he had all his uniform except a sword, and the tradition is Mrs. Lawrence gave him a sword that had belonged to her gallant husband.

Hunter was commissioned a commander in the navy and assigned to the command of the *Montgomery*, a gunboat attached to the East Gulf blockading squadron which was commanded by Rear Admiral Farragut.

The Admiral had known Hunter for years, the families were intimate, and Hunter was one of Farragut's "boys." Farragut knew his determination, his courage, his willingness to go ahead and take chances. One day, so the story goes, in the cabin of the *Hartford*, the Admiral spoke to Hunter of the exploits of the *Blanche* and of how pleased he would be if she were captured, and he said something to the effect, "If you fall in with her, Charlie, you will know what to do."

Of course it is impossible to know what was actually said, or what was in Farragut's mind or even if the conversation actually occurred, but it has long been believed in Hunter's family the Admiral conveyed the impression that if Hunter captured the runner even without the law, and should thereby suffer the extreme penalty to satisfy an irate nation, the Admiral would turn his blind eye to informalities, and at all events would come to the rescue if aid was needed, after the war should be over.

Hunter was not the man to ask questions or to beg for details. The hint was sufficient. Doubtless he made up his mind that if he had the opportunity he would end the career of the *Blanche*, one way or another. The opportunity came and he seized it; at the port of Mariano about five miles west of Havana the burnt and twisted hull of the *Blanche* was soon lying on the beach. Thirty-six years later, Lieutenant John Hood, of the navy, in another war drove ashore and wrecked the armed Spanish liner *Alfonso XII* at Mariel a few miles further to the westward.

Before dawn on October 7, 1862, the *Montgomery*, several days out of New York, lay to, off the light on Morro Castle, Havana. When day broke she lowered a boat, and her captain went ashore to communicate with our Consul General Schufeldt.

It so happened that also lying-to waiting for daylight to go into port was the English mail steamer *Trent,* which exactly eleven months before, that is November 7, 1861, had been held up in the Bahama Channel by the U. S. S. *San Jacinto* and the Confederate Commissioners Mason and Slidell taken out and removed to the man-of-war.

Hunter had a long interview with Consul General Schufeldt,* himself formerly a naval officer (and soon to re-enter the navy and serve with great distinction), but what they discussed is not a part of this narrative. Hunter did not return to the *Montgomery* until about one o'clock, when the ship got under way and stood to the northward and westward.

About an hour later a steamer was sighted to the southward and westward, standing to the eastward close in shore. At this time the *Montgomery* was about five miles from land.

The next chapter of the story is briefly told in the ship's log.

October 7, 12—4 P. M.

At 2 saw a steamer inshore of us; fired a blank cartridge from the rifled gun, but she would not stop. At 2.20 a shell being jammed in the rifled gun fired it toward the rebel steamer. The shell struck 600 yards from ourselves only. She then showed English colors, and stopped her engine heading for shore.

At 2.30 thinking her ashore sent in two boats armed, in charge of Acting Master Arthur to examine her. At 3 the boats boarded her, and it was almost immediately perceived she was on fire. Got men into the boats again, and in ten minutes she was in a solid sheet of flame.

Two men from the steamer got into one of the boats, and were brought to this vessel.

The steamer was the *General Rusk* from Indianola for Havana, with cotton cargo. At the time of the boats boarding her she was aground. At 3.45 the boats returned; took them up, and kept away down along the coast, steering a safe distance from land. At 4 Moro East, distant eight miles.

In the subsequent investigations by both the Spanish and American naval courts, the facts as stated in the log book of the *Montgomery* were practically substantiated. These facts were amplified by the various witnesses, but other allegations derogatory to the Americans were entirely disproved; the most serious of these was the accusation that Master Arthur and his men had set the steamer on fire.

* Commodore R. W. Schufeldt, U. S. N.

It is now convenient to turn to the *Blanche*. She was commanded by a native of New Orleans named R. H. Smith. According to his testimony before the Spanish court "in the ever faithful city of Havana," as the record runs, the *Blanche* sailed from La Vaca, Texas, on September 29, for Havana, with a cargo of 569 bales of cotton valued at $142,000. On October 4, she had stopped at the port of Mulato at the west end of Cuba for twenty-four hours to coal and pick up a pilot. When the *Montgomery* fired the blank shot she put into Mariano, and sent a boat ashore with the pilot to request protection of the Spanish authorities. The Sea Alcalde and his son responded to the call, and Captain Smith delivered the *Blanche* to the Alcalde, who hoisted the Spanish colors over the English.

At this time the boats from the *Montgomery* were seen pulling toward the *Blanche*, the *Montgomery* being at the time about one mile from shore. The captain, observing that the men in the boats were armed with pistols and cutlasses, slipped the cable and beached his ship.

When Master Arthur boarded the *Blanche* he demanded the ship's papers, and was given only a provisional register, a crew list, a table of crew's wages, and a certificate of ownership; there was no clearance, no bills of lading, no manifest. As a matter of fact it was proved afterwards that the ship's books and papers had been destroyed by the captain's order in the fire room, just as the boarding party got alongside.

Arthur told the captain that he would have to take the ship out, and sent an engineer whom he had brought with him into the engine room, which was on the main deck, to see if the engines were all right; almost simultaneously with the report that they were, fire broke out below, and in a few minutes the ship was blazing from stern to stem.

The *Blanche* had offered no resistance, nor had any personal violence been committed by the *Montgomery's* men.

When the fire drove the people out of the ship, they all got ashore except the pilot, and an English passenger named Clement, both of whom escaped in the *Montgomery's* boats. The pilot was transferred that night to a passing Spanish schooner bound for Havana, and Clement was given passage to Pensacola whither the *Montgomery* was bound and where he arrived on October 11.

Hunter was apparently well pleased with his action, as was also the Admiral. Under date of October 14 he writes to his wife:

We leave in the morning to blockade off Mobile. I wrote you a few lines from Havana a week ago today. I went on shore in my boat and remained three hours, bought some fruit and a few segars. Saw the Consul and left before noon. Got on board in an hour and was steering west along the coast of Cuba. About 2 saw a steamer south of us going east. We then only eight miles from Havana, headed towards the steamer, fired a gun at her without shot. She did not stop but was going rapidly towards Havana very near the shore. Fired a shell towards her. She stopped, showed English colors and anchored. Sent two armed boats to her. She hoisted Spanish colors over the English when she saw our boats coming and ran her on shore. Our boats boarded her, and the engineer I had sent was backing the engines when it was perceived she was on fire and crew escaping. Our boats returned on board. I remained long enough to see her half consumed and left. She was the notorious *General Rusk* with English papers and was called by them the *Blanche*. She had run the blockade five times. They were very foolish to set her on fire for if I had forcibly taken her off, the English would have made the Spanish government pay for her, and if I had met her at sea and sent her in to our ports, the court would not have condemned her.

I was congratulated by the Admiral for my good fortune in catching the rascal. I hope I may be the means of destroying half a dozen more which are in Havana to sail to any place they can get in. I am to cruise twenty and thirty miles from Mobile at my request or suggestion to the Admiral, as the steamers expect to be about that distance off just at night and run in before morning.

We arrived last Friday. I went to the Admiral's ship. He asked me to dine, met Palmer, Captain Hitchcock and Alden, pleasant dinner.

There are six or seven rebel steamers at Havana bound for any of the blockaded ports in the Gulf that they can get in. They will all have English papers—but that will not deter me from seizing them if I meet them at sea. There is a rascally Englishman at Havana, that swears that he owns the steamer or rebel sailing vessel, and then gets a register for her from the English consul.

When our boats were leaving the burning steamer two men jumped into them. One was a Spanish pilot that the steamer had taken on board at the west end of Cuba—the other an Englishman that was going to Havana from Texas. I let the Spaniard go that night putting him on board a small vessel going to Havana. The other I brought along and have taken his deposition about where the steamer was bound, where from, and that he believed that she was fired by her own crew. And now he goes to New Orleans to get to England where he was bound. He lost all his clothes.

A few days later Hunter captured the *Caroline* loaded with French muskets, munitions, cigars, stationery, etc. When captured she was from Havana, and endeavoring to get into Mobile.

In a letter dated October 28, describing the chase and capture of the *Caroline*, Hunter says:

There are two men of the *Caroline's* crew that were in the *General Rusk* when she was burnt. The Captain (of the *Blanche*) and all hands swore most positively that we set fire to her, and the Spanish government made a great fuss and sent out three Frigates to catch us. I hope I may be ordered home on that affair. I want to catch another rascal and then I shall think I have done my share, particularly if he is as important a one as the *Caroline*. I saw this same vessel when I was in Havana, she was coaling directly under the consul's windows, there are four or five other rascals there waiting to come out. I am afraid they will hear that we are waiting for them and not come this way. The men and officers are all so glad and I am happy for them and myself that the *Montgomery* has done something. I would not give her up for any vessel out here, unless we were going into a fight with the rebels at Fort Morgan and in Mobile Bay, then I would prefer a vessel with more guns.

Hunter speaks of the rum on board of the *Caroline* which he had had locked up, but which, when at Pensacola he sees one of the men "groggy," he determines to destroy:

Of this he says:

I had no legal right to do so but felt I had moral right. I stood by and saw the heads of thirty-two five-gallon demi-johns knocked off and their contents poured into the ocean.

This cruising outside is much more endurable than remaining at anchor blockading. I want to catch another rascal but our chance is diminished since the *Cuyler* is here too. I shall keep outside of her if I can and away from her.

I have written to William* to say to Mr. Seward that the two men sent home in the *Caroline* as a part of her crew were in the *Blanche* when she was burnt, and ought to be detained as criminals for that act, —which I see that the Captain and crew swore that we did—or the depositions of these men should be taken that the vessel was fired by the Captain or by his orders. If I am not ordered home on account of the *Blanche* a court of enquiry may be ordered out here to ascertain under oath all the facts of the case.

He speaks of a schooner from Philadelphia to which he sends a boat notwithstanding heavy weather "as I do not permit any vessel to pass without examining her papers."

*William Hunter in State Department.

December 10, Mobile Bar.

Commodore Bell ordered me to anchor about a mile to the west of his ship, to keep full steam always at night, to have the guns ready and men at them and ready to fire at an instant's notice, and to be ready to slip our cable immediately that any of the rebels appeared coming out; there are now nine or ten, yes I believe twelve vessels blockading—enough I should think to keep the *Oreto* in.

We ought to be allowed to go by Fort Morgan even if we cannot take it. I suppose *Ironclads* may be sent here, they can put their vessels near the fort and bang away in security and will get all the credit—while many of the vessels here have been months and months engaged in the most trying of all duties, blockading.

He speaks of a sloop they had taken, the *Wm. E. Chester*, loaded with cotton, nine bales of which had been thrown overboard to lighten her sufficiently to cross the bar. He had cruised about and picked up every bale.

I have written to the Admiral to know what I shall do with the nine bales of cotton that we picked up. We might have sold it at Pensacola for twenty-six hundred dollars but I was not sure I had a right to do so—and fearing that I might do wrong, and as it was a money transaction to operate for my benefit in part, I was more cautious not to assume responsibility; I would rather the whole and hundred times as much should be entirely lost than anyone say I did wrong to benefit myself pecuniarily—I rather would be broken for the *Blanche* affair than even suspected of wrong in any money transaction.

December 14, 1862, Off Mobile Bar.

We are still at anchor in the same position where I let it go a week since. I suppose that we are to remain here until we want coal again, which will be in five or six weeks. I saw a fortnight ago, symptoms of a little feeling on the part of the other vessels at the bar that the *Montgomery* was too lucky and that her being outside was considered by them to be a comment upon their want of vigilance here when we caught a vessel that had come out. I then thought that, as the Admiral is away, the next in command would, upon the plea that we were necessary at the bar, to chase the *Oreto* when she should come out, be detained here and so we are. We could do more good outside, but others think perhaps we are more useful here—but I cannot complain and shall say nothing unless another vessel is sent out to take our place outside, then I could ask the Admiral if our action there was not satisfactory to him and express my regrets that it was not.

It rained in torrents the day of the *Blanche* investigation, and Captain Hitchcock came on board and I got wet seeing him off, and it was very cold the next day. I still have hopes of being recalled on the *Blanche*

affair; if I had not sent boats to ascertain her character I would have been much blamed by navy officers and perhaps by the government—I could not help their burning the vessel. If we had got her off before she was set on fire I do not think I would have sent her in, and if I had, of course she would not have been condemned, but the Captain thought he would get better price for his cargo and vessel from our government by firing her than by going in. I hope he may be disappointed, our government ought not to pay a penny. If we had fired her of course we should have paid for her; the affair has caused so much discussion from the wicked perversion of facts by her Captain and crew swearing to such abominable falsehoods—I would send you the result of the investigation here but it is long and does not differ from what you already know.

The following letter shows how completely surprised he was at the action taken by the Department.

At Sea. January 10, 1863.

I write with a pencil as we are under way going fast and it shakes a good deal in the cabin right over the propeller. A week ago day before yesterday (Thursday) the *Circassion*, Captain Eaton, arrived. I went on board the *Susquehanna* in the P. M. about four where I saw Captain Eaton—he told me that he had a document for me on board his vessel marked important that he was ordered to deliver to me in person and take a receipt. He said he did not know its contents—I imagined it, and felt sure that I was ordered home and was very happy. I went on board the *Circassian* with Captain Eaton and he gave me the sealed document which on opening I found was the following (orders to turn *Montgomery* over to executive officer and return in her as passenger. Also orders to executive officer). This was killing—overwhelming after suffering so much and doing all in my power to aid the government in putting down the rebellion—to be disgraced and degraded is indeed hard. I have the sympathy of the navy—of those above me—I have no doubt, many enemies among the officers below me who want to get me out of their way. Fox is their friend and not mine. They thought I would resign rather than submit to the humiliation of being deprived of my command and ordered to come home under the executive officer—I gave up the command the next day. I shall not resign until I am tried, if I am to be tried, but after that I ought to do so, or at least do no more duty while the present unjust government is in power.

The officer in charge has been polite and has not assumed at all. I have retained the sole use of my cabin and servants. I am grieved and sorrowful at my own unjust treatment, and at the critical state of the country which appears to demand it to satisfy the clamors of Spain. We must be weak to give way to wickedly false statements as sent from Havana in regard to the *Blanche*. The government cannot punish me more than it has done even if it takes my commission from me.

As was to be expected Spain had at once made a vigorous protest. On October 20, Mr. Tassara, the Spanish minister at Washington, addressed a long letter to Mr. Seward on the part of his government and demanding "prompt and immediate satisfaction and reparation for all the wrong inflicted and all the interests damaged by the outrage, and the burning of the English vessel, the *Blanche*, on the beach of Mariano (Mariel)."

The Minister summed up the "offenses" under four heads:

1. Violation of the jurisdictional maritime belt of Cuba.
2. Insulting Spanish authority in the person of the Sea Alcalde, aggravated by the "capture" of the pilot and taking him out of the country.
3. Insult offered to the Spanish flag together with another neutral flag.
4. Burning of a neutral merchant vessel without respect to existing treaties.

On November 30, Captain Hunter's brother, who was in the State Department, wrote a letter congratulating him on the capture of the *Caroline* but had this to say about the *Blanche*.

> The Spanish are excessively indignant. Tassara their minister here has addressed three notes to us upon the subject, translations of two of which we have sent to the navy department to be forwarded to Admiral Farragut. . . . The object of the Spaniards of course is to show that there was a wilful violation of their territorial jurisdiction, and that the *Blanche* was set on fire by the boarding party from your vessel. They wish to fix the accountability upon our government. The *Blanche* though nominally owned by an Englishman named Wigg, is probably in reality the property of rebels, and in Texas and elsewhere on our coast is known only by the name of *General Rusk*. . . . The distance (from shore) is the most important point in the case, for you had no right to assert belligerent rights when nearer than three miles, as we say, but the Spaniards claim six miles, as the limit of their jurisdiction. This claim however will not probably be assented to by us. . . . It is to be hoped that you will get out of the scrape honorably to your professional discretion as well as spirit, but rebels and Spaniards are most vindictive adversaries.

The affair caused intense excitement in Madrid and bitter outbursts against the United States. However much the government might have wanted to save their face, the diplomatic conditions were such that an apology and disavowal were necessary. There was just a chance in Hunter's favor that might tend to

mitigate subsequent action. "Admiral Farragut," writes Mr. Walter Hunter, "seems to have supposed that the government ordered an investigation of the circumstances of the case of the *Blanche*, because it suspected he (Captain Hunter) had been remiss in failing to bring out the steamer as a prize. It does not seem to have occurred to him that there was any impropriety in his chasing and boarding a vessel within Cuban jurisdiction. Such being the case I find reason to hope that the court-martial will visit lightly an excess of zeal which involved a breach only of international obligations. The danger lies in the furious and persistent demands of Spain for 'the swift and condign punishment of the commander of the *Montgomery*,' and the anxiety of our government to avert her wrath and to toss some Jonah to the whale."

Under date of December 9, 1862, Lord Lyons, the British minister, in a letter to Mr. Seward presented on behalf of his government a claim for reparation of damages and injuries to British owners in the destruction of the *Blanche*.

To the Spanish minister Mr. Seward replied on October 23, in effect that the department had not received any information of the transaction mentioned, promised no delay in ascertaining the merits of the case, etc., and to Lord Lyons on December 10, he replied to the same effect.

It is worth noting that more than two months after the event, the Secretary of State had received "no reports or other information from its own agents of the material facts."

The Spanish Government presented claims for a total of $311,859.29½* and demanded the punishment of Commander Hunter. The English claims for damages were included in the Spanish claims.

It is interesting to read that as late as April 24, 1863, Mr. Seward wrote to Lord Lyons that the claim "would be given due consideration."

It was a much easier matter to settle the account with the naval officer. He was selected to be tossed to the whale!

Commander Hunter was brought to trial by a general court-martial which convened at the Boston navy yard in February, 1863. The president of the court was Rear Admiral S. L.

*Note the ½ cent!

Breese; and the members, Commodore Henry Eagle, J. L. Lardner, Captains Jas. Glyun, John Pope, T. T. Craven, and Chas. Green. The judge advocate was Harrey Jewell, Esq., of Boston.

Hunter was tried on two charges, the first violating the territorial jurisdiction of a neutral government. The first specification of the charge alleged that he took forcible possession of the *Blanche* within the territory of Spain, defied and insulted the Alcalde, and forcibly took away a Spanish and an English subject and held them as prisoners. The second specification alleged that he caused the *Blanche* to be set on fire.

The second charge was scandalous conduct tending to the destruction of good morals. There was only one specification under this charge, and it alleged that he extorted from the English subject a statement on oath that the *Blanche* had been set on fire by her own crew.

The Spanish naval court examined thirty-eight witnesses, and the Boston court thirty-seven witnesses. It was clearly proved that no personal violence had been offered the Spanish authorities —it was claimed that one of the *Montgomery's* men had slapped the face of the Alcalde's son—that the ship was set on fire by order of the captain of the *Blanche,* who had prepared for such an emergency before he left Indianola, to prevent her falling into Federal hands, and that the statement of the English subject that Hunter had forced him to sign under oath the ship had been fired by her own crew was false. It was further proved that in beaching his ship, the captain of the *Blanche* had been guilty of barratry.

Captain Hunter spoke at some length in his able defense, and he made clear an important point, which evidently however did not carry weight with the court. He said that admitting for the sake of argument that he had violated not only Spanish jurisdiction but *neutral* Spanish jurisdiction, that unless coupled with an allegation of disobedience of orders, unofficer-like conduct or the like, a violation of neutrality or jurisdiction is not an offense, within the meaning of the Articles of War or the Statutes of the United States to justify punishment. The Articles of War are silent on this head.

This argument is sound. A few years ago an officer was tried by general court-martial for grounding his ship, and under the charge of neglect of duty, the specification was alleged that he did not come on deck when a certain light was sighted, but this allegation was not coupled with any offense—as there is nothing in the regulations which requires a captain to come on deck when a light is sighted. The result was that the court acquitted the officer.

Hunter was found guilty of the first charge, and first specification; the second specification was not proved. He was honorably acquitted of the second charge. The court sentenced him to be dismissed from the navy.

Hunter's case was a *cause celebre*, and it was generally thought in the navy that he had been treated with undue severity.

Admiral Farragut wrote to him on June 17, 1863:

I was much pained that the government should have deemed it necessary to order you home for the investigation of the case of the *Blanche* as it deprived me of your services, which I much needed, but it should not have given you a moment's disquietude, as you knew that your *Admiral* and *Brother Officers* all considered that you had done your duty, and with that zeal that all good officers will do it; and leave it with the Judiciary to unravel the entanglements of the laws of nations, which it is not to be supposed an officer is at all times to be the proper judge.

When afloat I shall always be most happy to have you under my command; and although I do not expect again to have that honor I hope we may often meet on shore to talk over the pleasures and excitements of the past.

And again on August 24, 1863:

I received your kind letter, and regret that mine was so long in reaching you. I have not been able to get the particulars of your trial but am astonished to learn from you that you were dismissed by a court; I can understand that the government might find it convenient to sacrifice you to preserve our relations with Spain, at a moment when we could not afford to involve ourselves with an additional enemy, but I had no idea that you had been condemned by a court of naval officers. The government must have found some different testimony from that which I saw but I still hope all will come right; when I visit Washington I will find out all about it. I fear it will not be in my power to visit Newport, if I visit any of the watering places it will be Sharon to get the rheumatism out of my shoulders.

Hoping that we may yet serve together, and be co-workers to balance that *old account* (and not in a Privateer).

Captain Thornton A. Jenkins* wrote:

U. S. S. Oneida, July 5, 1863. (Pensacola)

I am sorry, truly sorry that you have been ordered home on account of that rebel vessel *Blanche* burnt by the Captain and her crew.

I have an abiding faith that Mr. Welles and his associates will do you full justice when they are made acquainted with the true state of the case. It is mortifying to an officer who is ever ready to sacrifice all comforts of life to endure every hardship of our misunderstood profession with faithful performance of duties some of them too of the most delicate and complicated character to be censured. Still I am greatly mistaken in Mr. Welles if he does not see that you have full justice done to you in the end.

Let what may come and what may be done, there are those here who will never cease or fail to remember and speak of the energy, zeal and intelligence displayed by you on this station and especially on this blockade. Keep your spirits. All may be lost save honor. So long as we have our honor and full assurance of having done our whole duty let the world frown as it may, we may despise it.

Two years afterwards he received the following interesting letter from Senator Anthony:

Washington, January 21, 1865.

One day, last week, I sat next Vice-Admiral Farragut at dinner. I am sure you will be pleased to know that he spoke of you in high terms, as a most valuable and efficient officer; and he thought you had suffered very unfairly. Seward was present, and said "if you will ask for him, when you next take a command, I think he will be put back." Farragut said he certainly would do so, and added that he would like to be on the court-martial when an officer was tried for such an offense as was alleged against you.

As this was said at a private party I would not like to have it made public, but I have no objection to your reminding Farragut of it, if it would be of any service to you.

It was a matter of great gratification to Captain Hunter that nearly nine years after the affair of the *Blanche* one of the most distinguished officers of the navy should have shown his good will by sending him the following letter:

1409—K St., Washington, June 1, 1871.

I am solicited to be in Newport on the seventh of July next to attend a meeting or re-union of the "Army and Navy of the Gulf" of which society Admiral Farragut was the late president.

I hope you will join and become one of us. We are to meet in the Academy of Music and a banquet will follow. My family will accompany

*Afterward Rear Admiral.

me on their way to Portsmouth, N. H., where they propose staying during the hot months. As you were one of the most earnest and self-sacrificing naval officers of the war, I desire you to join us. General Phil. Sheridan is first vice-president and I am second, and a president is to be elected.

With kindest regards to your family,
I remain truly your friend,
THEODORUS BAILEY.
R A.

The affair of the *Blanche* followed the *Trent* affair by eleven months and preceded the cutting out of the *Florida* in Bahia by exactly one year to the day. In all three cases the action of the naval officer was approved by the country, but disavowed by the government as an independent act of officers. In the words of the Secretary of State in the *Florida* affair, which applied to the other two, "it was an unauthorized, unlawful and indefensible exercise of the naval force of the United States."

For his part in the *Trent* affair, Captain Wilkes was at first commended and afterwards censured. Commander Collins of the *Florida* was never brought to trial; his punishment was an order to take the *Florida* will all prisoners back to Bahia and deliver the vessel to the Brazilian Government. However while lying in the stream at Hampton Roads, she was rammed by an army transport, but not badly injured. Later she sank at her moorings off Newport News, and the incident was closed.

Commander Hunter was dismissed from the Navy, but in 1867 he was restored, and placed on the retired list as captain.

Whatever satisfaction the Government may have enjoyed secretly in the unlawful acts of Wilkes, Collins and Hunter, it was for obvious reasons necessary to publicly disavow them. Nevertheless these officers rendered distinguished service to their country by so doing, and although they sacrificed themselves each won honorable fame.

Commodore Duncan Ingraham in the *St. Louis* would have violated the neutrality of Turkey by sinking the Austrian corvette *Hussar* in the harbor of Smyrna, if the Austrian captain had not complied with the demand to give up Martin Kosta, and for his determined action Congress voted him thanks and a sword. The commander of the British light cruiser did violate the neutrality

of Chili in 1915 when he sank the *Dresden* in Juan Fernandez. Many similar examples could be cited if space permitted.

If history teaches anything it is this: when in doubt it is better to go ahead, act boldly and take the chances. Blind obedience to orders, "playing to the program" as the politicians say, never got a man anywhere; on the contrary, it has ruined many a career.

The conclusion of the whole matter may be summed up in a paraphrase of the words of a recent writer, "Do what you think is right, even when it is wrong."

But every officer faced with opportunity must decide the question for himself. There is no rule.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE INFLUENCE OF MATERIAL ON NAVAL OPERATIONS

By Hector C. Bywater

Not so very long ago the editor of a certain British naval periodical invited me to contribute an article dealing with some phase of the Battle of Jutland. On my suggesting that a comparison of the material—ships, armor, guns, projectiles, etc.—at the disposal of the British and German Fleets might be interesting and instructive, he showed some hesitation, and finally remarked that he would prefer me to write of the human element and the influence that discipline, training, and tradition had exercised on the course and result of the Jutland action, adding that in his opinion the material factor was of negligible importance, especially in this particular battle, where the opposing fleets were evenly matched as far as the quality of their weapons was concerned. This disinclination to examine problems of naval tactics from the hard, matter-of-fact viewpoint of the so-called materialist and the tendency to concentrate instead on the more romantic aspects of naval history, such as individual gallantry, the facing of heavy odds, and heroic efforts, not always successful, to compensate for deficiencies of material by sheer courage and will to win, is very marked among naval students; and anyone who attempts to assign to material its proper value in modern naval operations is liable to find himself crying in the wilderness. And yet it is impossible to dip into the records of sea warfare, especially during the past seventy years, without realizing the prosaic fact, unpalatable though it be to historians of the sentimental school, that the outcome of a naval engagement is always largely governed, and sometimes mainly decided, by the qualities or defects of the material employed.

It need hardly be said that a superiority in material produces the most decisive results when there is virtual equality on the human side, and such equality must necessarily be assumed in any academic discussion on the relative value of naval weapons. Numerous examples could be quoted in which one fleet, superior in numbers and equipment but manned by crews of faulty morale, discipline, and training, and led by a commander of weak and vacillating character, has been utterly routed by another fleet inferior in numbers and armament but handled and fought with skill and resolution. So far as the World War is concerned, it may be said without fear of contradiction that for the first two years or so there was little to choose between the British and German Fleets in respect of the courage, discipline, training, and devotion of officers and men. This was, moreover, the period that witnessed all the most important naval operations, and it is therefore the period that offers the most promising field for a study of the influence of material on modern sea tactics. That the subject is much too vast to be dealt with adequately in a few pages of print goes without saying, and in the limited space at disposal it will be impossible to do more than touch upon the salient data derived from the World War which are pertinent to the issue.

No comparison of the British and German Fleets as they stood in August, 1914, is of much value unless it takes into account various considerations which governed the respective shipbuilding policies of the two powers. While it would be futile to pretend that the British Fleet during the years immediately preceding the war had not been developed largely with an eye to its eventual employment against Germany, it is nevertheless a fact that the North Sea, although recognized as the most likely battleground of the future, was by no means the only sphere with which British naval strategists were preoccupied. Thus, if battleships, cruisers, etc., were designed primarily for fighting in North Sea waters, it was still held to be essential that they should be able, if necessary, to operate just as effectively in any other quarter of the navigable globe. In other words, the British ships of 1914 were, in the well-known phrase, built to "go anywhere and do anything." This involved the pre-emption of a not inconsiderable proportion of the total weight and space in each ship for purposes

which did not conduce directly to fighting efficiency. It was necessary, for instance, to provide the officers and men with better living quarters than would have been required had the ships been meant only to make short cruises in the vicinity of their coasts. It was necessary, also, that they should have a large fuel capacity, and, further, that their efficiency for battle should remain unaffected even when they carried their maximum supply of fuel and stores.

These requirements, coupled with the demand for higher speeds and heavier armament than were found in contemporary foreign ships, imposed a most difficult task on British naval constructors, and one that was more complicated than that which German designers had to solve. For the German Fleet was created for the express purpose of fighting Great Britain, and all its capital ships were designed for work in the North Sea or the Baltic, the contingency of their having to operate at points many thousands of miles distant from the Fatherland being thought so remote as not to justify special provision. In the case of these ships, therefore, a lower standard of habitability could be accepted, and although the fuel capacity of German dreadnaughts was nominally as large as that of British vessels of equivalent displacement, it was actually very much less, because many of the coal-bunkers were so placed as to be almost inaccessible and probably were rarely, if ever, used for their ostensible purpose, being regarded rather as part of the protective system of the ship. This particular point has been overlooked in previous comparisons of British and German material, but it will be appreciated by those who inspected the German ships surrendered after the Armistice. On the other hand, it is only fair to acknowledge the great technical skill of German constructors and the ingenuity which they displayed in utilizing every fraction of displacement and every cubic foot of space for increasing the fighting efficiency of the ship.

German capital ships were, indeed, not cruising ships but fighting ships *par excellence*. Moreover, they were designed on tactical principles which differed in some important respects from those favored by the British Admiralty. Grand-Admiral von Tirpitz, the creator of the Imperial German Navy, had his own ideas about warship design, and it must be admitted that

many of them were vindicated by war experience. In his judgment, the first requirement of a vessel built for the line of battle was that it should keep afloat and retain its power to fight even after receiving very heavy punishment. It was useless, he argued, to endow a ship with tremendous offensive power while at the same time leaving her so vulnerable that she might be knocked out by a lucky hit before she had a chance of bringing her weight to bear. When the first British battle cruisers of the *Invincible* class came into service, Tirpitz called them "Fisher's ten-minute ships," meaning that ten minutes was the limit of time they could hope to remain in the battle line in view of their very light protection. The fate of the *Invincible* and the *Indefatigable* at Jutland seemed to corroborate this estimate, while, on the other hand, the survival of most of the German battle cruisers after a terrific hammering from large-caliber guns testified to the soundness of the Tirpitz theory that protection was a feature of design which could not be subordinated to armament or speed without incurring the risk of summary destruction.

Again, the loss of the *Queen Mary, Invincible* and *Indefatigable* furnishes a conclusive answer to those who maintain that the personal element can always rise superior to deficiencies of material. Animated by dauntless courage, thoroughly efficient in every branch of their work, the thousands of splendid officers and men in these three ships were, nevertheless, the victims of a fatal defect in material which they could under no circumstances have overcome. Why the three ships should have been destroyed so easily is a mystery which has never been solved, and probably never will be unless their designs are made available for inspection. It seems, however, that those who inspired the designs had miscalculated the effect of fire from medium caliber guns, for it is notorious that each of the three vessels succumbed to a few salvos of twelve-inch and eleven-inch shell. In these early British battle cruisers an attempt was made to give them a speed that would enable them to choose their own range, and guns of sufficient power to outshoot the enemy, the idea being that the latter should be brought under fire and knocked out before he, with his lighter and shorter-ranging weapons, could reply with any effect. But the Germans, with great prevision, had forestalled this plan by giving their ships a degree of protection

that enabled them to resist this initial punishment, thus compelling the heavier-armed but more vulnerable British ships to come nearer, in order to make their fire more decisive, and incidentally bring themselves within range of the lighter but very effective German artillery.

There seems no doubt that Lord Fisher and the tactical school he represented had exaggerated the effect on *well-armored ships* of a few hits from heavy shell. On the strength of paper formulae it had been calculated that a few rounds from 13.5-inch or 15-inch shell would put any ship out of commission. This, however, was so far from being the case that after the Battle of Jutland twenty-five hits from 15-inch shell and as many more from projectiles of lesser caliber were counted on the *Derflinger* alone; yet the ship was still afloat, her machinery was intact, and she was still able to use part of her armament. What is the explanation of this striking discrepancy between, on the one hand, the theoretical and the actual results of British gunfire at Jutland, and, on the other, the powers of resistance exhibited by battle cruisers of the respective fleets? The answer is easy. British principles of design and armament were based for the most part on theory, while the German principles were founded upon actual experience derived from tests. During the years that the British naval authorities were building up their dreadnaught fleet they made very few experiments to determine debatable points relating to design, and never, to the best of the writer's belief, undertook such gunnery tests as might, and probably would, have given them betimes the experience that was purchased so dearly during the war. Germany, on the contrary, prefaced each new stage of development by exhaustive experiments made regardless of cost. The gunnery and torpedo trials alone which they carried out between 1908 and 1914 must have run into a figure exceeding the cost of an additional dreadnaught, yet this lavish expenditure on practical demonstration was undoubtedly the soundest form of economy in the long run. On one occasion they built a target representing the midship side and underwater section of a modern battleship; it weighed several thousand tons, and was used principally for trying out alternative methods of localizing sub-surface explosion. By this drastic method they were able to perfect underwater protection

to such a degree that not a single German capital ship of the dreadnaught type was lost by torpedo or mine, though casualties of this nature were far more common in the German Fleet than in the British. Gunnery tests were conducted on the same realistic and extensive scale. In the years before the war the High Sea Fleet regularly fired at whole squadrons of obsolete ships, some of which had been partly reconstructed for the purpose and fitted with modern armor-plate over part of their hulls. Experiments of this kind not only gave invaluable practice in gun pointing, fire control, and fire discipline, which subsequently bore good fruit in the war, but rendered it possible to test the various types of projectiles and thus enabled the Germans to produce the remarkably efficient armor-piercing shell that made their gunnery so effective at Jutland.

So convinced was von Tirpitz of the value of stout armor protection and extensive subdivision, that rather than sacrifice this feature he was content to give his battle cruisers a lower speed than that of their British "opposite numbers" and to arm both them and his battleships with guns of smaller caliber than were mounted in the British Fleet. He claimed that the adoption of this lighter armament involved no real sacrifice of fighting power, because the Krupp guns were superior in accuracy and all other ballistic properties, and could drive their projectiles through the comparatively thin armor of British ships at maximum battle range. By accepting smaller guns he saved a great deal of weight that was mostly utilized for improving protection, though some allowance had to be made for the greater weight of the German cartridges, which had to be packed in brass cases owing to the construction of the Krupp breech-block. It may be pointed out, in passing, that the ideal of unsinkability which German constructors strove to attain had long prevailed in their navy, for as far back as 1896, Herr Dietrich, on the designing staff of the German Admiralty, stated in a paper read before one of the learned societies that German warships of that day differed from the British in that they were divided up into as many watertight compartments as was deemed possible without interfering with the working of the vessel. "Perhaps," he added, "we have already gone too far in this, and service on board may be obstructed. Every athwartship bulkhead is solid and un-

pierced. Communication from one engine room to another or from one stokehold to another must be established only over the protective deck above water, or may be carried on below by telegraphs and speaking tubes."

Some interesting particulars of the development of German armor-piercing shells were given in a book, *Die Technik im Weltkriege,* published in Berlin after the war. In this volume Naval Constructor Betzhold offers the following observations on British ammunition at the Battle of Jutland, though his patent desire to make propaganda for German industry has probably led him into some exaggeration. "The British projectiles in part did not burst at all, and in part detonated outside the armor; while the German fuse did not produce an explosion until the shell had passed through the armor. The composition and stowage of the British powder charges and their inadequate protection formed an ever-present source of danger to the whole ship. Both in disposition and thickness the British armor proved unequal to the attack of the medium caliber German guns; on the other hand, the strength and quality of the German armor was such as to defeat attack by the heaviest British calibers. The 15-inch shell was unable to penetrate our 13.7-inch armor even at ranges from six and one-quarter to nine and one-half miles." Another writer in the same volume, Commander Kinzel, states, with reference to the superior functioning of the German projectiles, that the Ordnance Department of the Marine Amt had long recognized the importance of improving A. P. shell and had devoted endless thought and experiment to the subject. "Thus, the German shell used at Jutland was the result of years of collaboration between the naval authorities and the firm of Krupp. It was made of Krupp crucible nickel-chrome steel, which was unsurpassed in hardness and toughness. It tapered at the nose to a long and fine point, which was protected by a cap made of softer material. The discovery of the most favorable form and the most suitable material for this cap was only made after numerous experiments, which cost a great deal of money. To obtain the maximum effect from a burst it was necessary to employ a highly-explosive aromatic composition; but since substances of this nature usually detonate upon impact against armor, the difficult problem had to be solved of so 'phlegmatizing' the charge that it could be brought

safely through the thickest armor, though without in any way impairing the violence of its disruption. The severity of this problem may be judged by the fact that at the date of Jutland the British had not succeeded in solving it. In spite of prolonged experiments, they had been compelled to load their armor-piercing shell almost exclusively with black powder* which, although less sensitive, was far less efficient than the high explosive compounds. Equal care was displayed in perfecting the fuse, which is, of course, the all-important element of an A. P. projectile. Thanks to an unwearying devotion to duty, which rose superior to the many disappointments met with, we succeeded eventually in devising a delay-action fuse which was unaffected by any shock, and which allowed the intact projectile to penetrate well into the vitals of a hostile ship and then caused it to explode. In this wise, therefore, was put into the hands of the German Fleet an armor-piercing shell as perfect as human foresight could make it—a weapon superior to anything that our foemen possessed."

Here we have a typical example of that patient, scientific striving for perfection which made German naval equipment so efficient and formidable on the day of battle. Thanks to their superior range-finders and fire-control apparatus—which had been developed on the same principle of thoroughness and attention to detail—the German gunners were usually able to get on to the target almost at once, and once they had found it they knew that every shell that went home could be depended on to produce the maximum effect. This, unfortunately, could not be said of the British projectiles in use at the date of Jutland. As Lord Jellicoe afterwards wrote: "The battle convinced us that our armor-piercing shell was inferior in its penetrative power to that used by the Germans, and immediately after the action I represented this with a view to immediate investigation. With one of the old type of armor-piercing shells of a particular caliber as used at Jutland the shell would, with oblique impact at battle range, break up whilst holing a certain thickness of plate, and the shell could not, therefore, reach the vitals of the enemy's ships. A shell of the new type and same caliber, as produced by the 1917 committee, would at the same oblique impact and

* This statement is inaccurate.—H. C. B.

range pass whole through a plate of double the thickness before exploding, and could, therefore, with delay-action fuse, penetrate to the magazines of a capital ship. Had our ships possessed the new type of A. P. shell at Jutland, many of the enemy's vessels, instead of being only damaged, would probably not have been able to reach port." How, in face of this admission, is it possible to maintain that the material factor is of negligible importance in naval combat? As a consequence of the neglect to produce a thoroughly efficient projectile, much of the fine work done by British gunners at Jutland was lost endeavor. Eighteen months later (November, 1917) there occurred an incident that further emphasized the lesson. A British squadron, which included the battle cruiser *Repulse*, surprised German mine-sweepers at work in the Bight under cover of a light cruiser screen. A brief action ensued at high speed, during which the *Repulse* scored a raking hit from her 15-inch battery on the German light cruiser *Königsberg*. The projectile, weighing over 1,900 pounds, passed through all the funnels and exploded in one of the forward bunkers. It broke up into a few large fragments, the detonation being so feeble that only minor local damage was done. Had this shell functioned efficiently it would probably have destroyed the ship.

As with gunnery equipment, so with torpedoes and mines: the German weapons were of uniformly high quality and rarely failed to do what they were expected to do. The torpedoes generally ran true, thanks to meticulous care in manufacture and adjustment, and the effect of their explosion was always disastrous because the war-head was exceptionally large—the desirability of increasing the charge having been demonstrated by peace-time experiments. The German type of mine, too, retained its supremacy to the end of the war. This high standard of material was not due to any inherent superiority of German science or engineering. Invention is not, and never has been, the German forte. But where the race excels is in its capacity for improving on the ideas of others, for taking up an idea at the point where it has been dropped by the originator and patiently improving it to the utmost limit. This faculty has led to remarkable results in many spheres of activity other than that of naval

technique, e. g., the development of aniline dyes, synthetic drugs, and optical glass.

In the writer's opinion, experience has proved beyond dispute that good material is as essential as good personnel to the attainment of decisive results in modern naval warfare, that the two elements are interdependent, and that serious shortcomings in the one cannot be balanced by superiority in the other. Naval men who insist on the vital importance of aiming at super-quality in ships, armament, and equipment may be dubbed "materialists" by the unthinking, but the epithet is really a term of honor. There was a time, it is true, when false doctrines of materialism prevailed in the higher councils of the British Navy; when it was believed that the key to victory lay in huge displacements and monster ordnance; and when so much attention was devoted to the piling up of tons and guns that perfection in detail was neglected, with the result that the advantage conferred by superior weight and numbers was largely nullified. But the lesson has been taken to heart, and today the British Navy is second to none in its zeal for one hundred per cent efficiency in material, no less than in personnel.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

GUN DEFENSE AGAINST TORPEDO PLANES

By Lieutenant Commander R. K. Turner, U. S. Navy, and Lieutenant T. D. Ruddock, U. S. Navy

Guns and the methods of controlling their fire have been developed for use against objects moving in but two dimensions; for this reason we now find it difficult to use them effectively against airplanes, which move in three. In the course of development we may expect the effectiveness of anti-aircraft guns to increase very considerably, but only after we have designed them and their mounts, and have adapted methods for their control, for their special use in this activity. Until that time, however, we must make the best use of the weapons at hand, and if we can simplify the problem by eliminating the third, which is the most troublesome dimension, we shall doubtless find our problem's solution much easier.

A study of a part of the problem will show the principal gun defense of a fleet against attacks by torpedo planes may be handled in this manner. Indeed, it is probable that this defense will be very similar to that now provided against other torpedo attacks and that, in fact, heavy ships will have less to fear from torpedo attacks by planes than by other torpedo carriers, chiefly because the planes will always have considerable difficulty in launching torpedoes successfully at night. The possibility of using the ordinary secondary defense batteries against torpedo planes has occurred to many people; the object of this paper is to present in more or less complete form the general plan for so using these batteries. It is when the plane gets down near the water, as it must to make a successful torpedo drop, that it loses its power of using the vertical dimension for its own protection, and thus takes on the character of surface craft. Few special appliances

will be necessary for the battery operation, and these, and the special ammunition, can be provided in a very short time if necessary.

Since the torpedo plane is a new instrument of sea warfare, and one with which we have had very little experience, it is somewhat difficult to arrive at any very definite conclusions as to its tactics in delivering an attack. Generally, however, it can be safely assumed that it will approach at high altitude until near its point of attack, then drop as rapidly as possible to the surface of the water, head for its target and, as soon as steady, drop the torpedo.

Due to the fact that torpedo planes must necessarily be large, their speed will in all probability be low and their angle of descent small; it also can be safely assumed that the speed at which a torpedo can be launched from a plane is limited to a very slow plane speed. With these assumptions in mind we may proceed to the consideration of the problem in hand, that of placing such a plane under fire from the maximum number of guns at the earliest moment and assuring a reasonable chance of successful fire against it.

The plane will of course be attacked by the anti-aircraft guns as soon as sighted, but the probability is small of inflicting any damage with these at any except short ranges. The range at which the plane drops near the water will be inside the maximum range of the torpedo carried by the plane. During the descent of the plane it will come under the fire of the secondary battery when its angle of position is equal to the maximum angle of elevation of the secondary battery guns, minus the angle of elevation for the range of the plane. From this point on the plane may be kept under a continuous fire from the secondary battery, using shrapnel or high explosive shell.

The time during which the plane is in a zone dangerous to itself is dependent on the range at which it descends and also where it launches its torpedo. It may be assumed that under present circumstances a plane will probably not drop its torpedo at a distance greater than 2,000 yards. The straight run from the point of descent to 2,000 yards may be taken as the space during which the attack may be repulsed. The time to make this run is dependent on the plane speed, and if we assume that the minimum speed is in the neighborhood of sixty miles per hour, and the

maximum about one hundred miles, we may use then a mean speed of eighty miles for the purpose of a time analysis. If the plane comes under fire at a range of 4,000 yards, then at eighty miles per hour the time to reach 2,000 yards is fifty-one seconds. This time being so short seems to show that the general scheme of firing should be a barrage through which the plane must move in its approach and one which obviates the necessity of spotting. Hence, the control must be as nearly automatic as possible, and require few operations of sight and fuse setting.

Before proceeding further a few definitions of the terms used in the following discussion will be given so as to avoid misunderstanding.

1. A ladder is an automatic movement (without spotting) of the point of burst or impact of successive salvos.

2. A down ladder is one in which the points of burst or impact of successive salvos are moved toward the gun.

3. An up ladder is the reverse of (2).

4. A barrage is a series of salvos the shots of which are somewhat dispersed in elevation and azimuth and so placed that they should intercept the target.

5. A moving barrage is one which has the points of burst or impact of shell moved according to some prearranged plan (as, for instance, a ladder).

There are three alternative methods of placing a barrage across the path of an approaching airplane which will be taken up in sequence and treated in their various relations to probability of hitting and ease of manipulation. These are: 1. A stationary barrage short of the initial position of the plane; 2. A moving barrage with the first shot beyond the initial position; and 3. A moving barrage with the first shot short of the initial position.

The first method gives small chances of hitting the approaching plane because the short time involved precludes the possibility of enveloping the plane with the bursts of more than one or two salvos during the approach, and it is possible that the zone of fire may be avoided by the plane. With the second method the barrage is started beyond the plane and moved toward the ship at a rate faster than the rate of approach of the plane, and it is thus practically sure of catching it at least once if the difference in rates is sufficiently great, and with this moving barrage there

is a chance of having the plane within the danger space of the barrage for perhaps four or five salvos. With the third method the barrage is started short and is moved toward the ship at a rate which is less than the speed of the approaching plane. These last two methods will give excellent results provided the rate of movement of the barrage is not greatly different from that of the plane and it is started reasonably close to the target.

In discussing the rates of approach of the barrage in cases 2 and 3, a plane speed and a firing interval must be assumed. There is a maximum speed of plane at which a torpedo can be dropped and still have the torpedo in effective running condition. There is also a minimum speed at which the plane can sustain itself in the air. A combination of these factors seems to point to a plane speed for dropping the torpedo of about sixty miles per hour. To show the relative rates of approach of airplanes at different speeds during the salvo interval, the following table is given computed on the basis that the rates of approach of ship and plane, a resultant of their speeds projected on the line of bearing, remain constant. This may be called the "apparent" speed of the plane.

Salvo Interval Seconds	Plane travel yards per salvo at speed indicated				
	90	80	70	60	50
10	440	390	340	290	240
8	350	310	270	230	200
6	260	230	210	180	150

Upon an inspection of the above table the idea is presented that the size of the ladder in a moving barrage is closely connected with the speed of the plane, and that for slow speeds a small ladder is required, while for high speeds a larger ladder is necessary.

To a certain extent this is true in the case of the No. 3 barrage, in which the initial salvo is made to fall short of the target, because otherwise it might be possible for the plane to escape by not running into the barrage at all. For instance, suppose we conclude that, under average circumstances, we will be able to keep the plane under fire for one minute, since it will probably take that long to dive, straighten out, and drop the torpedo. Then

if we use a salvo interval of 10 seconds and a down ladder of 200 yards per salvo, a plane moving at an apparent speed of ninety miles per hour will run into the barrage at the rate of 240 yards per salvo, while a plane moving at an apparent speed of sixty miles will approach the barrage at only 90 yards per salvo. In one minute we may fire but seven salvos, which would allow the faster plane to run 1,440 yards and the slower plane but 540 yards towards the barrage. While it is possible to bring the fast plane into the midst of one or two salvos, it might easily happen that the slow plane would escape altogether unless a smaller ladder were chosen. Furthermore, if a salvo interval of less than 10 seconds is used, a smaller ladder is necessary; for an 8-second interval a ladder of 150 yards, and for a 6-second salvo a ladder of 100 yards would meet the needs of the situation. With No. 3 barrage in use, therefore, we may conclude that an estimate must be made of the plane speed if the best results are to be attained.

Suppose we now consider the case of No. 2 barrage, viz., that starting beyond the target and moving in at a faster rate than the plane. It would be necessary to have the barrage start just beyond the plane and move toward the ship at a rate only slightly in excess of that of the plane or else to start it far out and move it toward the ship at a rate which will arrive at short range in about one minute. The latter method would seem to be the better of the two, as it is independent of the plane speed and can be made automatic. Suppose the barrage is started with a fuse setting of 5,000 yards and moved at such a rate as to reach about 1,000 yards in one minute (this corresponds to a plane speed of 136 miles), and is then held at this range. With a salvo interval of 6 seconds this would mean a down ladder per salvo of 400 yards. Now as the bursts will vary as much as 100 yards short of and beyond the mean point of burst, and the danger space covers at least 25 yards beyond the farthest burst, the space covered per salvo is about 225 yards, which means that in sweeping from 5,000 yards to 1,000 yards fifty-six per cent of the space covered in the approach will be thoroughly swept by the bursts of the shrapnel or shell, and if the plane is making less than 136 miles apparent speed the barrage is sure to catch it and probably hold it for more than one salvo. If we are unable to fire every six

seconds, but fire every seven and one half seconds, we will fire nine salvos during the approach, or one salvo every 500 yards.

However, we may consider that, for the present, we are safe in covering plane speeds of from 60 to 110 miles per hour, and we will endeavor to sweep the sea from a range of 5,000 yards down to 1,000 yards. A 110-mile plane travels 4,000 yards in 75 seconds; therefore, if we fire every 8 seconds, we will fire 10 salvos during this time, including the first. This will require a 450-yard ladder, and the average salvo dispersion should cause fifty per cent of the approach to be covered effectively. A 60-mile plane could start 1,900 yards ahead of the barrage and be caught before arrival at the 1,000 yard range, and the average plane of eighty miles speed could start 1,200 yards ahead of the barrage and be caught. The 80-mile plane travels 310 yards per salvo, the barrage approaching at the rate of 140 yards per salvo; one salvo is therefore sure to envelop the plane, and there is a sixty per cent chance that a second will also.

A short barrage moved similarly to the over barrage (No. 2) can be employed but it is not believed it would be as effective as the over barrage because it can more easily be avoided and if it is started too soon there will be considerable difficulty in telling whether or not the first salvo has been fired at too short a range. No. 2 barrage seems to afford the best chance of hitting with the minimum number of fuse settings and the least amount of ammunition necessary at the guns. For instance, if we use a stationary barrage, to be moved by spotting, several rows of projectiles with the fuses set to various ranges must be available at the gun, while with the over barrage each row of projectiles represents a full barrage against a plane and the same number of projectiles represents a more effective defense.

The maximum range that would ever be employed as the starting point for anti-torpedo plane barrage has been suggested above as 5,000 yards. Steps should be taken to determine this range and make it standard. Of course, the barrage need not be started at the maximum range but in cases where the range of the plane is known to be shorter it could be started with normal salvo No. 2, 3, 4, etc. Upon arrival at the 2,000, 1,500, or 1,000 yard range, whichever is determined upon as the most suitable, the barrage, if in front of the plane, should then be maintained stationary,

and kept going until the attack has been concluded. It may also be desirable, after the spotter observes the fall of the first salvo, to shift to another string of projectiles, starting at a different number without interruption of the fire. For instance, if the first salvo falls short, (in a No. 2 barrage), and the spotter observes this after the third salvo, he may order the guns to shift strings, and, instead of the next salvo being No. 4 of the first string, it might be No. 2 of a second string; the latter series would then be fired to conclusion.

Either of the two following procedures of fire control can be used as seems best:

(a) Have the sights set on all guns at the maximum range that will ever be used in laying an anti-torpedo plane barrage and do not change them during the approach of the plane. Point each gun in elevation individually but use the director circuit for firing so as to be sure of the salvo interval. All guns that are loaded should fire every salvo.

Train all guns using the broadside director system. Set no deflection except an initial estimate but cause the director trainer to train to the right or left of the target plane to introduce the deflections as desired. This requires no spotting other than a change in the trainer's point of aim and assures all guns firing at the proper target. Convergence correctors at all gun training receivers should be set at infinity to give lateral dispersion.

(b) Point all guns for both elevation and azimuth by the director system.

Train the director operators so that they can fire at definite time intervals.

Set the director sight for range for each salvo in accordance with a prearranged table furnished the sight setter.

Use an initial deflection setting and spot for deflection but don't hold salvos for the spots.

Set convergence correctors at guns to infinity to give lateral dispersion.

The only new material required to put a scheme of this character into operation is a quantity of five-inch shrapnel or high explosive projectiles (the latter preferably) fitted with time fuses, and also efficient fuse-setters. Both of these can easily be obtained on comparatively short notice. For a moving barrage the fuses should be set in advance and the shell placed in racks near the guns. In order to avoid deterioration of the fuse time train from moisure the protective caps should be replaced after the fuses are set and made airtight with a coating of shellac.

It has been stated that a heavy water barrage at from 2,000 to 3,000 yards range will prevent planes from launching torpedoes, but this remains to be proved. While water affects greatly the planes' flying qualities, it does not prevent flying altogether, and since the splashes from five-inch projectiles are small, and ordinary common shell don't always explode on water impact, a method more sure of actually doing damage must be adopted.

The system of organizing the batteries of the ships of a division to act as a unit, as has been suggested elsewhere in the case of the anti-aircraft batteries, seems feasible here as well. Each ship should use a slightly different ladder, but all should fire with the shortest possible salvo interval. In this way a heavier concentration can be obtained and a greater range of plane speeds be covered. For instance, with four ships in a division, each firing an average salvo of five guns every eight seconds, and starting the initial salvo at a point 5,000 yards, 45° on the bow of the leader, the space to a point 1,000 yards on the leader's bow may be very effectively covered by the following assignment of ladders:

Ship A—400 yard ladder.
Ship B—500 yard ladder.
Ship C—300 yard ladder.
Ship D—250 yard ladder.

With these ladders 49 salvos will be distributed close together from 5,000 to 1,000 yards from the leader and 15 more salvos at 1,000 yards range, all within a space of two minutes. The total shots fired will be 320.

The chief points to be emphasized in the fire control system for defense against torpedo planes are:

(a) The system must provide for a very large volume of fire in a short time.

(b) The control must be automatic so as not to interrupt the fire.

(c) The present material should be used so far as possible.

The exact details, as regards size of ladders, position of initial salvo, concentration by two or more ships, etc., may easily be worked out by co-operative exercises between a division of battleships and a group of planes. Such exercises should form a part of a training period in the near future.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SCIENCE AND THE NAVY

By Lieutenant Commander Fitzhugh Green, U. S. Navy

Our new navy has suffered one great loss: science as an avocation.

The naval officer is a fair executive, something of a marine engineer, and can deal superficially in both kinds of ballistics. The best of him stands high.

So did the best of Mr. Gladstone. He was a statesman of exceeding greatness. Yet on the occasion of his visit to Charles Darwin he regaled the father of the missing link with Bulgarian politics! Another time he called on Faraday, of whom it is said: "The English electrician; his work lives wherever a dynamo spins; who is in the airplane, the deep sea cable, the lights that light the ways of the world, wherever electricity serves our kind!" Gladstone listened courteously while the spark-guardian explained. Then grimly he asked, "But what good is it all?" Whereat the unabashed Faraday descended to the parliamentarian's level and replied: "Why, sir, presently you will be able to tax it!"

When the young Darwin cruised in the *Beagle* he brought back a fund of knowledge which the world still draws upon. The young naval officer will cover the same track under infinitely better conditions and bring back a Patagonian blow-gun he bought in Valparaiso and a rejuvenated acquaintance with the Bowditch.

The point is we are letting the specialists get away from us. No officer need be capable of designing an 18-inch gun or a high-pressure step-down transformer. But at least he should keep enough brushed up on tensile strength and voltage not to take any shoddy on deliveries. No officer need wear an alphabet after his name and know the etiology of a sun-spot. But it certainly

should be a matter of professional pride for him to keep in touch with the amazing strides of modern meteorology.

We send our picked postgraduates to the best technical schools in the country. Ask one what his first impressions were. "How infinitely little I knew about anything!" he'll exclaim.

Yet he knows a little bit about a great many things. Witness the list on his Annapolis diploma. The trouble has been the same that mortified Gladstone: he has no vision of science and history as a whole; is ignorant of the elementary ideas of biology and geophysics; of political, social, and economic science, of modern thought and literature.

It isn't necessary to be a walking cyclopedia to possess breadth. More is it a combination of an inquiring spirit with the habit of observation.

A set of instructions to cover the deficit would be difficult to draw up. Imagine a graduation address running so: "Young gentlemen, you have finished your course. You know enough to be ensigns in the navy. On the other hand your general ignorance is appalling. You will sail the seas with but a smattering of oceanography. Though by compass you will conn the ship, yet of terrestrial physics you are innocent. Landmarks shall loom, submergence lines baffle, while geology is alien to your rut-hung curiosity. Fishes in the sea, kelp upon the shore, air and the sun that warms it, guiding stars by night, strange peoples that you meet, very timbers underfoot, how shall you bring them home to the people who cannot wander? *Words*—words and less—in the glib sterility of your conversation. Young gentlemen, you are barely on the threshold of the world of knowledge. Make science your hobby and the universe shall open like a steamed clam!"

There would be applause. Applause at that moment is an unwritten law. But there'd also be some stifled jeers.

No, you can't go to a boy and say: "Boy, here is a book on entomology. It's all about bugs. You'll like it. It has nine hundred pages and twenty colored engravings. Entomology is a profoundly interesting subject." He might be polite; R. H. I. P.

But if you took him out in the woods and got him full of chiggers and he didn't believe there crouched a tiny bug beneath

each crater on his itching back; and you dug one out and let him look through a microscope at the pink wriggler; and then told him there were well-known bugs which man has never seen, too small for even the most powerful microscope to disclose; and explained the meaning of osmosis, and how the size of these infinitesimal bugs was determined by their osmotic abilities, using filters of varying densities, whence they are called *filterables*—why, the first thing you know that boy would be stealing fleas from Fido so he could work out how far a man could jump were he relatively as strong.

The Smithsonian used to go on that principle. Thirty years ago naval officers made hobbies out of natural sciences. Some of the best collections in both the National and American Museums hold many contributions from seafaring men. The British Museum makes no secret of its dependence upon military travellers for invaluable trophies and relics.

Pick up any scientific journal. World-wide scientific information is exploited above all else. What are the sources: paid savants and foreign federal employees. The former are too limited in number, the latter too limited in scientific perspective. Yet reports from our consular service give meat in some form or other to nearly every scientific paper that appears. Should it not then be a source of embarrassment that we of the navy, most travelled of all federal employees, glean nothing for our country? And lest there be some quibbler who would produce an average intelligence report as evidence to the contrary, it may be added that no better examples of the untrained observer in social, political, or ethnic sciences can be found than in just such papers.

What, then, can we do? There is no room to cram more courses into the Naval Academy curriculum. The average officer has only a limited amount of time for study in the press of ship or shore routine. And this time he would mostly prefer applied to professional lines. It looks like a saturated market from every point of view.

From every point of view but one: habit of mind. Take Pelmanism. Millions of dollars are being spent in advertising it. Hundreds of converts are daily being made. Yet of what does

it consist other than a method for putting to work the wasted inertia of a man's intelligence?

Start a navy system. *Develop the mental characteristics that promote a scientific attitude.*

They are definite enough. All research starts with curiosity. Curiosity is like any other appetite. It is fierce desire to begin with. When fed regularly it retains its pristine vigor. When starved it languishes and its owner eventually dies—intellectually at least. Fundamentally it should be the source of most mental energy and effort. Its impulse is the germ of progress.

Second is the hunting instinct. This is more brutal than curiosity. It comes out in competition like sport. We find it in the spirit of target practices, in the pursuit of mechanical short-cuts, in the striving to surpass cleverer professional contemporaries.

Third is the inborn tendency to hoard. Few individuals fail to enjoy some sort of collection—books, oddities, stamps, photographs. Like a rivulet this instinct may easily be diverted into channels wherefrom good may grow, scientific profit to one's self, one's profession, one's country.

Finally comes the instinct of workmanship which is more limited in the average. But even it is seldom entirely lacking in men with naval training. And the merest shadow of it can give the willing investigator or observer a means for interpreting much that he encounters in his wanderings about the world.

Next, and more specific, is the scientific attitude itself. To the youth in whom the four instincts above have been purposefully bred, modern science takes on a new and broader semblance. It becomes at once a sublime quintessence of common sense.

The savage had his fatalism. Thunder and lightning were just noisy flashes in the heavens, their meaning or value as distant as the clouds from which they leaped. The ancient had his prejudice. Scarcely a century ago men burned witches in Salem. Some of us cross our fingers to this day.

But modern science knows neither fatalism nor prejudice. It believes absolutely in the uniformity of nature. It calmly views the most terrific cataclysms of nature with profound assurance that each part and movement is but some definite cog in the gigantic mechanism of the universe. This, then, should

invariably be the balanced attitude of those who would see science in its true light.

The tone of that attitude must also be developed. There is danger of getting sidetracked. Professional peril can arise from a too great and absorbing interest in any one line. Mahan's contemporaries tell us he became so wrapped up in his military writings that he sometimes lost sight of the daily task. We are glad that he did. But he is the exception whose diversion should have been the original intent. The average of us dare not tempt habit to any such extent any more than we would risk taking morphine every day for a week. No matter how normal and healthy we were we might find the hunger had grown upon us.

No, the navy man above all others must have great breadth in his science hobbies. This can be reached through his pride alone. Ask one if he knows the ten most important advances in science in the last twenty years. And when he shows his dense ignorance by naming only two, rest assured he will stand his next watch pondering the profundity of his lack of education.

The idea is not far-fetched. Try the list one recent authority gives. At the forefront come the Brownian movements. Some of us have encountered them in our thermo-dynamics. Next, the divisibility of the atom. The naval aeronaut should appreciate what that means to our future aviation. And there is radio-activity—more in the surgeon's line. Yet a lump the size of a hen-house would, if its energy could be realized, operate the *Tennessee* from New York to Brest and back again continuously for 2,000 years! The atomicity of an electric current may be common knowledge to our radio experts. It is a safe wager, though, that the average turret officer doesn't yet know that if his hoist current could be magnified infinitely it would look not unlike a river of shining marbles. In the same line is the recent proof of the electric origin of all matter. This hangs on the sixth discovery, the "nucleus atom." Nothing more startling has ever been announced than the fact that each apparently indivisible speck of matter is in truth a whole solar system with billions of tiny electrified planets dashing about within it. Seventh and eighth are the X-Rays and their application to investigation of crystal structure. And, finally, are the radiatory qualities between

different substances and the latest theory of "quantum relations."

Could there be a better method of taking down the vanity of a self-assured member of the most technical profession in the world than by proving that he is just about a mile behind the times?

Possibly it all sounds too theoretical. The vigorously practical naval officer naturally demands to know what good a scientific attitude can be put to. His life is too matter-of-fact to deal with such abstractions as human instincts which go into making a man acquisitive of scientific information.

There are two main lines of practical application. One has to do with the future of the navy; the other with its present. As to the future we may argue from the classical examples of history. About 5,000 years ago the Egyptians knew so little about building that only rough uncut stones were piled about their dead. Scarcely 100 years later a mammoth pyramid was erected. Giant blocks eighteen feet on a side were fitted together in an exquisite perfection of union that would defy our most skilful modern builder. In 500 B. C. the Greeks likewise achieved a rate of progress in aesthetic culture that has never since been exceeded. Results have yet to be equaled even in our modern vanity of civilization.

Sad but illuminating were the terminations of both. In neither case was permanence attained. With unerring cruelty Fate overthrew both Egyptian and Greek successes so thoroughly that but crumbling ruins remain today. There was a reason. Listen:

In the past hundred years has come about an industrial revolution that surpasses the combined advances of all the two thousand previous years. In the past thirty years the naval profession has leaped into a refinement of mechanical complexity which still is difficult to account for.

Will it stay? Shall we continue to fabricate a seagoing military mechanism so cheap, so efficient, and so nationally valuable that it will constitute an asset to the country in peace as well as in war?

The answer can be simply framed. Egypt and Greece were like a wrestler who has through pure chance fallen upon a new hold. For a while this hold on progress was used triumphantly. Then lethargy came. Men grew content; lived in the past. There

was no originality, no striving for new things, no vision. The *scientific attitude* was yet unborn.

That was the reason for the debacle.

Not so different a fate awaits the navy whose personnel choose to glory in its past. Seeds sown by the few inspired beginners of our modern fleets fell upon the fertile ground of scientific investigators then at the pinnacle of their strength in industrial application. Let us dare neglect the soil or the seeds for successive crops and we, like Pharaoh's tribe, shall wake up some day to find the mechanical majesty of our high-seas past but a vanished dream.

We shall discover that our civilian specialists have become so *ingrown* that no longer can we understand them; so *unprompted* that they are no longer practical—at least so far as the use of their arts in sea warfare is concerned; so *erudite* we must stand aghast at their incongruity.

The other and immediate application of the scientific attitude may itself be divided into two parts: one, the actual collection of scientific data and general information during travel; the other, appropriate prompting of civilian experts upon whom we must depend more and more as time goes on.

A few examples of recent notoriety will suffice. No problem is more pressing in the world today than the one of fuel. Fascinating then is speculation on distilling alcohol from cellulose ferment. Already this is a general practice. The novelty lies in the source of the cellulose. Several have turned up. The Nile Sudd deposit is 35,000 square miles in extent. If fermented it would produce 80,000,000,000 gallons of alcohol yearly for an indefinite period! There is undiscovered oil and coal in the arctic and in Central America. Who is keeping the government abreast of such precious information? Consular agents and military or industrial travellers mostly.

Who could best? *The trained naval observer.*

The thrifty Dane has started using seaweed for fodder. He boils it down, presses and dries it, and crystallizes out the undesirable salts. Result gives a sixty-six per cent digestible carbonic hydrate with thirteen per cent protein. No, we navy men are not farmers. But the taxes that support us and buy our ships are largely paid by agricultural districts. Is it not our

duty, selfish duty if you will, to nurse our popularity along by a contribution now and then? Kansas hasn't any seacoast. Kansas wouldn't fear the enemy fleet when war began. But let one navy man be responsible for any idea that gives Kansas a million tons of cheap cattle food and Kansas would be voting an adequate navy for the next twenty years!

There is a Mexican cactus called *sisal*. It has thick and pulpy leaves five feet long. Sisal will grow on pretty nearly anything but a concrete walk. Its fibre has just the elasticity and stiffness to make an excellent binder twine. Twenty tons of digested fibre can be turned out by a tractor desiccator in about two hours. See the commercial possibilities in it? Information like that is worth money to a live promoter. Yet money is not what interests us. The thing is that it's our business while floating round the world to pick bits here and there that will make for trade and commerce, for the merchant fleet still struggling in its afterbirth.

Last year an energetic Englishman left his ship at a Chilean port and struck 'cross-country for a week. He discovered that the country possessed 32,000,000 acres of wooded land in her uninhabited wilds. Nearly all our newspaper, much of our book and writing paper, comes from wood pulp. These new Chilean timber lands could supply all the newspapers in the world for 500 years! Yet the biggest dailies are this minute gasping for breath in the form of wood pulp America can't or won't supply.

A consul searched the environs of Bahia and found nearly a hundred species of drug-bearing plants. Such an inexhaustible supply of raw material might well shatter certain branches of so delicate a business as that of therapeutic chemicals. What have our naval surgeons been doing who visited Bahia these years past?

When food prices were soaring an inquisitive individual travelled down the Chesapeake and found over sixty species of game fishes. Many had not yet been exploited, or were not supposed to be edible. We don't study icthyology at Annapolis; but somehow fishes ought to be included in the mariner's repertoire of information.

The other day one of our weather men contrived a formula for predicting how warm it will be on any set day in the future

—the distant future, mind you. It reads: T=Ma plus Ra cos t plus Rd cos t'. T is the temperature sought. Ma is the mean annual temperature for the place; Ra is the greatest annual change, and Rd the same for the day. T and t are regular expressions of the date and time by clock. Very interesting and valuable, indeed. But can't you feel a twinge of mild reproach that a navy man hasn't done something of the sort? What is a seaman's business if it isn't weather above all else?

Sometimes, in the navy, his business may be war. Yet the point still holds. Captain von Mueller of the German raider *Emden* was a great student of racial ethics. It is recorded that the science of peoples and their customs had been a hobby with him for many years. When war came he found innumerable opportunities to make use of his esoteric knowledge.

September found him in the Bay of Bengal. Commerce of Southern India was just then gradually emerging from its chaos. A bold stroke was necessary to impress the enemy with Germany's power. Von Mueller played the single card which at that moment could take all tricks. With the cold logic of science he struck for Madras. After dark he opened fire on two huge oil tanks near the shore. Flames leaped into the sky, lighting up the countryside with a fearful glare. Natives were terrified. Money lenders from all the East Coast towns packed up and took to the hills. Without them no business could go on. Thus did von Mueller's pre-war hobby achieve a tragic derangement of India's business for a length of time that was counted by the British a real disaster.

All these examples lead us back to the original theme: the true test of an education is not whether it enables a man to make a living, but whether it equips him to interpret correctly the life around him.

When Morse invented his telegraph he nearly starved to death. Congress hesitated six years before it would appropriate $30,000 to test his device. In all that august body there was wanting a majority to envision what successful swift communication would mean to a distance-hampered world. Action was delayed by one Congressman who proposed an amendment that half the money be given for an investigation of mesmerism. And finally the vote passed by only 89 to 83.

We in the navy are in exactly the same position as Congress. We have it in our power to appropriate not money but information to thousands of waiting inventors, industries, and utilities. What we gather in the distant markets of the world may seem silly and insignificant to us. To the right person at home it may mean everything.

Then there is the other form of profit: the satisfaction of travelling with one's eyes open, of seeing the meaning in what goes on about. And finally, there is that deepest professional duty: to live and to learn without cessation of effort or degree through all the years at sea and ashore, so that when the crucial moment comes there can be no failing *because we didn't know.*

Ex scientio tridens!

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE DOLLAR AT SEA

By Commander Paul P. Blackburn, U. S. Navy

"Efficiency with economy" is the slogan of the day in governmental activities as well as in those of the commercial world. Economy without efficiency is parsimony; efficiency without economy is extravagance. The organization which is to function properly can be neither parsimonious nor extravagant; it must be economical or it fails. The navy has a definite constant mission and it has also a definite annual appropriation. "Money makes the mariner go," to alter the familiar adage; unless the navy gets full value in results for every dollar expended, those inclined to be critical might transpose this to read "the mariner makes the money go."

A fundamental difference exists between the point of view of the business man and that of the naval officer. The business man considers his every action as it affects his business with reference to the result of that action on the power of the business to produce more dollars or a greater result per dollar. The naval officer in his activities at sea considers the result in efficiency to be attained as paramount without giving constant consideration to the expenditure of money necessary to obtain the result.

During war the element of time is too important to give great consideration to the element of cost and the expense involved in any activity is subordinated to speedy accomplishment of the mission. While the World War was in progress money was plentifully supplied for all naval activities and the tendency to lose sight of the cost became almost a fixed habit of mind.

Today, the demand of the country for a decrease in the expenses of government is reflected by reduced Congressional appropriations for maintenance and operation of the navy. In consequence it becomes imperative that the navy get greater efficiency

for each dollar expended. To do this, the officers of the navy must adopt the business man's point of view and constantly keep in sight the dollar in their official actions. The manufacturer desires efficiency in his plant, the professional man in his relations with his clients, the tradesman in his store or ship, the artisan in his trade, the farmer in his farm, every branch of civil life strives for efficiency with economy. Commercial efficiency is measured in results per dollar; railroads compute cost per mile, factory managers are rated by their ability to decrease unit costs and the farmer lives by producing wheat at a low cost per bushel. Increased production coupled with decreased unit cost cannot be obtained without intensive study of the relation of the dollar to the finished product. If the navy at sea hopes to be more efficient with diminished funds, there should be an investigation into the cost of every activity with a view to reducing the cost or increasing the output, or both. Every officer on a ship bears a part of the responsibility for proper utilization of the ship and for proper return from the money spent in keeping the ship in commission and operating. Commanders-in-chief who formulate policies and issue orders requiring the expenditure of dollars have a greater responsibility in connection with economical administration than do their subordinates, yet the entire personnel of the fleet has its share in the cost of operation. More attention to the cost of everything the navy does, by every officer from admiral to newly graduated ensign, should so conserve the funds allotted to the navy by Congress that activities and training can be measurably increased.

For the fiscal year 1921, the individual costs of maintenance and operation of the first line battleships varied from $1,977,323.93 to $4,811,144.35 with a normal figure per battleship of about $2,500,000. This last amount was distributed approximately as follows: accrued pay $1,100,000; miscellaneous expense, including commuted rations $31,000; stores issued including provisions and medical stores $700,000; equipage $300,000; repairs and alterations to ships including equipage $369,000.

The item of pay is very nearly a fixed sum because the rate of pay is set by Congress and the number of officers and men on the ship is fixed by the Bureau of Navigation; the only control exercised over this by officers afloat is in the ratings held

by the men on board. Too many times the only basis for advancement of a man to a higher rating is his length of service in the lower rating; in civil life, the man's pay is a measure of his value to the organization. Officers contemplating the advancement of a man to a higher rating should ask themselves: "How much more money will this man get in the new rating? How much is he worth to the ship? Will the navy get full return for the additional pay this man will get?" Neither sentiment nor a desire to help out a well-behaved incompetent, but a cold matter-of-fact dollar basis should control.

Each officer should consult his own conscience and ask himself: "How can I make a greater return in service for what the United States pays me?" The navy pays an officer for what he does and he is obligated to prove his value in results. Examining boards must also put the dollar question to themselves and determine if the candidate for promotion will earn the pay of his new rank. Should any method of reduction of personnel by elimination ever come to pass, the officers and men who are worth the most will be the ones that the navy will keep. Those who pay poor dividends cannot be kept on the active list any more than a commercial firm can retain an employee who fails to aid production or sales.

"Miscellaneous expense, including commuted rations," is a very small part of the total expense, yet the summation of these figures for the whole navy for the fiscal year 1921, amounted to $6,793,161.21. Some of the items covered by this charge are mileage, canal tolls, postage, telegrams, pilotage; it seems probable that a part of this sum could have been saved had the individuals charged with the expenditure been as careful of the government's dollars as they are of their own.

"Stores issued, including provisions and medical stores" is the item of expense next in point of magnitude to the item of pay. It is also the item in which the greatest possibility for saving seems to exist. The "dollar-minded" officer, and all must become "dollar-minded," sees with a vision that covers the whole navy. He realizes the need for getting the greatest value for each dollar his ship spends, whether it is for paint, provisions, fuel, ammunition or anything else the ship uses. He must also realize the necessities of all the navy as one unit; dollars saved on the

Tuscarora may be made available for the needs of the *Swatara*. If the *Tuscarora* spends these dollars the *Swatara* does not get some much-needed improvement. No head of department aboard ship should hesitate to return an unexpended balance of a quarterly allotment for fear subsequent quarterly allotments will be reduced. If all hands combine to save money there will be more available for emergencies.

The cost of the navy ration has been cut down because supply officers are more likely to keep the dollar in mind than are most officers of the line or of other seagoing corps. Comparison of the cost of the ration on various ships has shown large inequalities and has had an excellent effect; the quality of the ration must be and is maintained; the cost of the ration is, in part, dependent on the duty of the ship but additional efforts of supply officers afloat may be able to save the United States additional dollars on every ship of the navy.

The engineering competition is generally effective in saving fuel, gallons or tons, but the saving is sometimes more apparent than real. The purpose of the standards set in engineering competition is to effect economies in fuel expenditure and that it generally effects this saving goes without saying. The natural desire to stand well in engineering competition may occasionally induce unnecessary expenditures of fuel to improve the engineering multiple. The savings are based on the competitive feature of the engineering performances but the advantage to the government of the actual saving of the cost of the fuel is not emphasized. Ask all engineer officers afloat how much money they have saved the government during any specified period by economies instituted, and it is believed that there are few who could give definite replies. Alterations and repairs to machinery should figure in the savings: The usual basis for requesting an alteration is the economy that can be effected by the change in the installation; how many times does the relation between the cost of the alteration and the monetary saving it will effect, enter into the determination of its desirability?

Flag officers can save dollars for fuel by reducing the "standby" time for getting under way, by planning the force exercises and the movements of individual ships so that the greatest result per dollar can be obtained, by cruising in formations that

use the least fuel and, in general, by giving thought to the dollars that any force activity or movement costs.

Captains, executive officers, heads of departments, watch officers and on forward to the seaman second class, have it within their power to save dollars for the government without sacrificing efficiency. Any waste, any unnecessary use, of an article that costs money reduces by a definite sum the amount that is available for the real purpose of the navy.

"Equipage" accounts for more than fifteen per cent of the cost of fleet maintenance and operation. The original cost of equipage is not controllable by officers afloat but the expense for replacement is controllable in a large measure. The possibility for big savings does not rest with those who salvage the used material; the users of the equipage are the individuals who can reduce the number of dollars expended by the exercise of greater care to prevent loss and deterioration or damage. If each officer and man should give the same care to government articles in his custody, or which he uses, that he gives his own property, the bill for replacements of equipage could be lessened and more dollars would be available to purchase new and improved equipment when needed.

The officers afloat can regulate in part the expenditures for "Repairs and alterations to ships, including equipage." Deterioration of material is inevitable and progress means improvement and alteration. It is in the preparation of requests for repairs and alterations that the money cost must be kept in sight. The value to the government in dollars and cents of the repair and alteration should be equal to the charge involved in making the repair or alteration. Repairs and alterations within the statutory limits of expenditures must measure up to this *quid pro quo* basis; an old ship with limited effective life will not repay in service for the expenditures that a newer ship would. Yet the older ship requires more money for upkeep than does the new one. A point is reached in the life of each ship when further considerable expenditure cannot be justified on economic grounds; the determination of this point may be difficult but an appraisal of the value, present and prospective, of the vessel to the navy will be of assistance in making the decision.

The navy is the first line of defense of the nation and expenditures for the navy in time of peace are the premiums paid for insurance against national disaster. The offensive and defensive strength of the fleet is paid for by every taxpayer of the United States and it is a high duty of every officer and man in the navy to use every effort to the end that the taxpayers receive full value in efficiency for every dollar that is appropriated for the use of the navy.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PROMOTION OF LINE OFFICERS OF THE NAVY

By Commander Willis W. Bradley, Jr., U. S. Navy

Several articles concerning the subject of the promotion of the commissioned personnel of the line of the navy have been published in the Naval Institute Proceedings during the last year or two. As would be expected, the views set forth are as many and the suggestions of the means for improving conditions are as far apart as, one might almost say, the stars in the heavens, but it will be nearer the exact truth to say the number of writers whose articles have appeared. Each writer naturally has his own ideas, his own pet hobbies, his own ambitions, or his own disappointments. It is not natural to expect any two officers to look at this question in exactly the same way.

The present writer appreciates that he is no different from the rest. He finds that he is unable to agree with many of the suggestions contained in the various articles and has not hesitated to so state to some of the gentlemen who wrote them. This has led to several requests that he set forth his opinion in what might be called constructive criticism instead of simply expressing it in destructive comment (more commonly called "knocking") of other people's ideas. He wishes to say that such criticism of previous articles as appears herein is given in a most friendly manner and asks that it be so accepted.

In this article it is intended to keep clear of such subjects as amalgamation of corps, desirability of specialists, etc. To include these subjects would make the discussion so drawn out that few people would care to take the time to read it.

The general assumption of many who write on this subject is that our present system of promotion (and of almost everything that pertains to promotion) is all wrong. Some writers are able

to find a few things worth retaining in the present laws. This makes it interesting and furnishes the necessary difference of opinion. Now for once, why not start by assuming that the present laws are fairly good and that the officers of the Navy Department who advocated them, the Congressional committees who drew them, the Congress that passed them, and, in general, the administration responsible for them, went rather deeply into the whole subject and produced laws, unquestionably having their defects, but the best that could be devised at that time? Since such an assumption would be rather refreshing, somewhat novel, and might give us a different viewpoint of the whole matter, I, for one, am going to consider it to be true, rather than that the whole thing was one great mistake.

It seems that this subject may be fairly well covered by asking three questions and by the discussion which must necessarily follow in giving logical answers.

First: Should every officer be retained in the service and be promoted when he becomes due by seniority unless his health fails, he gets court-martialed, retires voluntarily, resigns, or is otherwise separated from the naval service through some means that might be classed as a casualty?

I believe the very general answer to that question is—No!

The experiences of the navy before the days of selection were a very good answer to this question. Although the officers of the navy in general seldom agreed with the Plucking Board in all of its forced retirements, they were always practically unanimous in applauding some of its "selections." I also find that this is generally agreed upon by writers on this subject; for example, Lieutenant Commander Vossler in his article, "Promotion in the Navy" (U. S. NAVAL INSTITUTE PROCEEDINGS, No. 215, January, 1921) provides for the selection out of one half of one per cent of the commanders and of one per cent of the lieutenants and lieutenant commanders, and Lieutenant Commander Blasdel in his article, "A Solution of the Officer Personnel Situation" (U. S. NAVAL INSTITUTE PROCEEDINGS, No. 225, November, 1921) provides for the selection out of officers under certain conditions.

It seems then that we can agree that it is necessary to have some means to prevent every physically fit officer from remain-

ing on the active list until he reaches the age of retirement, that is, sixty-four. Just what this means should be; whether it should be selection out, opportunity for voluntary retirement, retirement for age in grade, compulsory retirement after being passed over one or more times, or some other scheme, is a subject for later discussion.

Second: Should an officer's entire future depend largely upon the age at which he entered the Naval Academy, always considering of course that he is at least an average officer and that he does not "commit" himself; or should there be some means by which he has a reasonable opportunity to get to flag rank if he can convince his seniors that he is just a little better than other eligible officers of his rank?

The old seniority law said—Yes, the age at which a youngster entered the Naval Academy is the greatest single factor in his career when nearing the top of the list for if he were not young when he entered he can never reach flag rank, and if he were not very young when he entered he can never have sufficient time in a flag grade to make it worth while for the department to even consider him for the position of a commander-in-chief. If a young man happened to be near the upper age limit when his opportunity to enter the Naval Academy occurred his chances of becoming a rear admiral were certainly small. He might be the best in the fleet, or even in the navy, but, unless his seniors died, retired, or were otherwise disposed of ahead of him, his case was hopeless; a temporary billet as a chief of bureau with ultimate reversion to the rank of captain was the best he could really hope for.

If such were the case under the system of seniority in the days of small Naval Academy classes, what would it be in twenty years from now when the classes of 1906 to 1910 and even lower begin to get near the top? Would the youngster who entered the class of 1909 at the age of nineteen have the slightest chance of getting flag rank? Most certainly not—not even the chance of the bootblack who aspires to become a bank president, for there is no law to stop him while the law of promotion by seniority was a stone wall which none could pass so long as younger men remained on the active list ahead of the aspirant in sufficient numbers to fill all vacancies. How does one think the contentment of

officers with such prospects would stack up with their contentment today? Under the present laws, they see every opportunity for advancement open ahead of them; under the old seniority laws they would form a large part of that "disheartened, disgruntled, and unhappy personnel" which Lieutenant Commander Blasdel mentions as now existing and the existence of which he blames to the present personnel laws.

The present promotion law says—No, an officer's entire future shall not be dependent upon whether his Congressman had an appointment to the Naval Academy available when this officer was a lad of sixteen or of nineteen. It says, in other words, that if the individual officer will so shape his career that his record and his reputation in the service show him to be a better man than his compatriots he can look forward with a reasonable degree of assurance to reaching flag rank. It also says that if he gets to flag rank he will be young enough so that he can have every opportunity to demonstrate his ability to command a division or a squadron and thus to show that he is the proper officer to be made a commander-in-chief.

The present law does not put the boy who enters near the upper age limit upon an exact par with the one who enters near the lower limit for as these officers approach the retiring ages of the various grades the younger will probably have more opportunities for selection than the older. There is no objection to this feature since the navy can expect somewhat longer service on the active list from the younger man.

Again referring to the two articles previously quoted, it is noted that while Lieutenant Commander Vossler makes provision for the possible selection of up to three per cent of the officers in the grades of lieutenant commander, commander, and captain, Lieutenant Commander Blasdel does not make any provision for such selection up, he maintaining that such a provision is unnecessary.

The writer believes that almost every officer will, when he considers the subject carefully, agree that a satisfactory system of promotion must be such that an officer of ability (say "exceptional ability" if you care to do so) will be afforded an opportunity to get to the top even though he may be sufficiently unfortunate as to be a year or more older than other officers of his date. To deny such an opportunity to these older officers

certainly tends to reduce their ambition and fails to furnish any incentive for their development as "exceptional officers." Such a denial would certainly tend to set up a class of officers as dissatisfied in some ways as those now are who have failed to be selected. The great difference would be that there would be more "without hopes" than there now are "passed overs" and that those "without hope" would never have had a chance to gain promotion by a demonstration of especial fitness while those now "passed over" are at least supposed to have had such an opportunity.

Which would be the better for the navy? There may be arguments on both sides but, personally, I believe that every officer and man should have a chance to reap the highest rewards if he has the ability to do so. For the purposes of this discussion I am, therefore, going to assume that the answer to the second question is that an officer's future shall not depend to such a great extent on his age when he entered the Naval Academy, that he is barred from the highest grades if he were eighteen months older than the average of his class.

Third: Recognizing the fact that it is necessary to eliminate a certain small number of officers from the navy for demonstrated lack of efficiency or for other kindred reasons and that it is essential that every young man who graduates from the Naval Academy and is commissioned shall have a reasonable opportunity to go to the highest grades, what system or method are we going to adopt to accomplish these results?

Let us first consider the means of eliminating from the active list those officers whom the service at large (necessarily represented by some sort of a selection board) deems unworthy of promotion. There are several means of carrying out this elimination, the most ordinary being by selection out (plucking), by retirement for age in grade, by offering an attractive voluntary retirement privilege, by compulsory retirement after an officer has been passed over a certain number of times, or by an involuntary transfer to a reserve corps (inactive status).

Although selection out is advocated by Lieutenant Commander Vossler this method seems to me to be unnecessary, to place a certain undesirable stigma on an officer selected out, and last but not least to be unworkable with the form of government estab-

lished in the United States. When an officer is selected out it is impossible for him or for anyone else to think of his case without involuntarily concluding that there must have been something wrong with him and that the selection out was really only an easy method of firing him. In some cases this may be so but, in nine cases out of ten at least, the officer so selected out has not committed any offense justifying so severe a punishment, he has simply not measured up to the standard of efficiency set by the great majority of his brother officers. Why, then, should such a stigma be placed upon an officer? My answer is—It should not be so placed. There are other methods of accomplishing the same result from the navy's point of view, with an entirely different result from the eliminated officer's point of view. I know that advocates of such a system as the one suggested by Lieutenant Commander Vossler will say that if an officer did not deserve to be selected out he would not be so selected since according to that system no specific number is designated to be eliminated. I think that this is false reasoning for by assuming that this is true one must concede that no one will ever be eliminated for inefficiency or that the selection board will be infallible in its findings and recommendations. The mere fact that selection boards are composed of representative human beings and are subject to ordinary frailties, likes, and dislikes, is the greatest reason usually advanced for doing away with the present method of selection. Selection boards, whether for selection up or for selection out, have made mistakes in the past, are making them now, and will continue to make them in the future. There is no Utopia for the candidate. It can't be achieved so long as mankind runs the board. There is too much chance for a mistake in selection out except as a last resort. An error once made cannot be rectified or even mitigated except by a restoration to the active list by act of Congress—something that experience has shown rather difficult of accomplishment. For the reasons suggested above the writer rejects "selection out" in any form as the best method of eliminating supposedly inefficient officers from the active list.

It might be noted in passing that the writer has carefully considered the suggestions in some articles that the defects of selection out might be corrected by giving an officer selected for retirement the right to demand a court of inquiry in his particular

case. This does not appeal to me since it would keep the navy's grievances always before the public eye and would soon lead people to believe that worthy officers were being railroaded out of the service to satisfy spite, jealousy, and other undesirable attributes.

Retirement for "age in grade" is a means of eliminating certain officers from the active list that does not seem to be open to any serious objections. There is absolutely no stigma attached to an age in grade retirement. It is a clean-cut retirement which allows one to go before his friends, the public, or a prospective employer, and to state plainly and without evasion the real cause of his retirement—that he was simply a little too old for his place in his grade on the active list. With the exception of voluntary retirement this seems to be altogether the best method of eliminating officers from the active list. It is believed that there can be very little question of the necessity of retirement for age in grade if there is to be a steady and healthy flow of promotion, without which the officers of the higher grades soon get too old for their billets and those in the lower grades soon get tired and discouraged waiting for some of the older ones to retire or die.

It is noted particularly that some officers who object to the age in grade retirement are prone to point to the promotions of the past five years as a sure sign that such retirements are not necessary (age in grade retirement not becoming fully effective until December 31, 1921). To see the fallacy of this argument one only has to look at the expansion of the naval personnel during this period and to compare that expansion with the probable expansion during the next ten years. There is certainly nothing to indicate that there will be any great expansion of the navy during the next decade.

The easiest method of creating vacancies to allow of a healthy flow of promotion is by voluntary retirement. The great trouble with this method is that normally the most active and energetic officers are the ones who see an opportunity of making good in civil life and that these, who can least be spared, are the very ones who will most often take advantage of a straight voluntary retirement offer. Even at its best it is to be expected that this method would let out more good officers than poor ones. On

this account no voluntary retirement privileges should be granted as a right (except in the case of officers "passed over"). Such a privilege should be "in the discretion of the President" thus allowing the department to hold any officer deemed especially desirable to the service.

After all has been said about elimination by "selection out," "age in grade," "voluntary retirement," etc., there is no question but that to get those officers on the retired list whom it is for the best interests of the service to have there it is absolutely necessary to use compulsion in some form. One of the best methods of such compulsion would be to retire officers involuntarily if they had been passed over a certain number of times after becoming eligible for selection. The best sort of a law for such retirement would be one which provided that any officer who was passed over could avail himself of the privilege of voluntary retirement at once; that any officer who was passed over a second time would be placed on the retired list sixty days after the date of the approval by the President of the findings and recommendations of the selection board which passed over him the second time, unless sooner retired voluntarily. It is believed that such a law would have three very beneficial effects: first, it would make the selection boards consider even more carefully the records of officers whose records show doubtful efficiency; second, it would provide a means of immediately getting off the active list for those officers who feel insulted, unfairly treated, or that their efficiency and usefulness have been ruined by the action of the board; third, it would furnish a means of compulsory retirement for those officers thus passed over, first giving them every reasonable opportunity to be placed on the retired list at their own request and thus escape any possible stigma of being "plucked" or otherwise forced out. This would completely do away with the small disgruntled element now on active duty who believe that their merits have not been properly appreciated by the various selection boards.

In this connection the writer desires to state that he believes that there is entirely too much made of the supposedly large element dissatisfied and disgruntled over present conditions. From a casual observation it may be said that nearly every officer passed over takes his medicine without complaint and settles

down to try to convince those in authority that he is worth much more than his record indicates. It seems to the writer the greater part of the agitation for radical changes and the greater number of claims of unjust treatment come from the friends and families of officers rather than from the officers themselves. Perhaps some of these statements are "inspired" but I believe the greater part of them are not.

Considering now the requirement that a perfectly satisfactory system of promotion (if such is even remotely possible) must provide some means of allowing the most efficient men to get to the top, even though these most efficient officers happen to be one or two years older than they should be, we are compelled to acknowledge that a straight system of promotion by seniority (without an enormous number of retirements in the highest grades) will not and cannot accomplish the purpose. To get the most efficient to the top and to keep them for any reasonable length of time absolutely requires some sort of a selection system.

I am aware that the conclusion herein mentioned is directly opposite to that drawn in Lieutenant Commander Blasdel's article in which he proposes that discrimination due to age shall be overcome by promotion to all grades after a given length of service in the preceding grade. He proposes that whenever the number of officers in a grade exceeds the number of officers authorized by law for that grade, the excess shall be either retired or placed in a reserve corps, and that they should then be employed to fill civil positions under the government. He does not say what he would pay them upon such transfer but it is assumed that they would be allowed a graded retirement pay of something like two and one-half per cent for each year of active service. Lieutenant Commander Blasdel states that there would be eventually about 1,600 captains on the reserve list and a proportionate number of other officers. Such numbers are, in my mind, entirely too large for Congress to even seriously consider such a proposition. I am one of those to whom he refers when he states, "Some emphatically state that Congress would never pass anything like that." Right there my agreement with him ends for I cannot concur in the next sentence, which reads, "This is ridiculous, for they are only retaining the services of those the

country has paid to educate, and employing them in positions, the total pay roll of which today is far and away greater than the total pay of all officers on the reserve list would amount to." For the sake of argument we grant immediately that the total pay roll of the various political and civil appointees who could be replaced by officers of the reserve list is greater than the difference in pay between the active and retired pay of the officers necessary to replace them. I think it questionable whether or not the total pay is greater.

The advocate of any such scheme must ask himself what kind of positions these reserve officers (especially the senior ones) will be willing to accept. Certainly they are not going to accept any of the ordinary civil service positions with salaries around $2,000 per year. They will insist on positions which seem in some way commensurate with their rank. This will restrict the available positions to those now occupied by relatively high salaried government employees. Does it not seem that the navy's experience with the lighthouse service and with fairly recent laws passed to restrict the employment of retired naval officers (such as the one concerning the acceptance of diplomatic or consular offices, the law regarding employment with firms doing business with the navy, etc.) are a sufficient answer to the probability of any long continued assignment of retired or reserve officers to desirable civil service or political positions? It is possible that Congress might relent, under pressure of economy or some other transient cause, and permit or even order the employment of retired officers in such positions but,—who believes that this would last for more than a year or two? The writer believes that the power of political appointments, this so-called "patronage," is too strong a factor in American political life to be lightly swept aside in favor of any one class of people, even though there might be some considerable pecuniary advantage in so doing. In the long run, a great many politicians are not so much concerned with the exact amount of money spent (so long as the treasury can supply it without new taxes) as they are with the proper maintenance and repair of their own particular political fences. This is an acknowledged fact in almost all modern forms of government. The opponents to the policy of filling up the consular corps or the diplomatic corps with retired or reserve officers

may also use the very legitimate objection that these same officers would, in all probability, be recalled for active service in case of hostilities—at the very time when experienced and well-known officials would be most in demand. Needless to say, a diplomatic or consular officer who "knows the ropes" and the people is a valuable man and is one who usually becomes more valuable as world relations become more strained.

Of the various forms of selection, the following seem to be the most acceptable and widely discussed:

Unlimited selection.

Limited selection; requiring certain service in the preceding grade before becoming eligible for promotion: requiring a certain amount of sea service in the previous grade, etc.

Selection of a certain percentage of eligible candidates for promotion; other vacancies to be filled by promotion by seniority.

Unlimited selection would open the field to so many evils that it is hardly to be considered seriously. There is certainly no real argument in favor of such selection except that it would make it possible to get the best men to the top regardless of age or time in grade. Such a procedure may be seriously objected to on the grounds that exceptional brilliance in one grade, without adequate service in that grade, is not any criterion of what would be accomplished in the next higher grade. It may also be truly stated that since a large part of any naval officer's education comes through actual experience in ships, no line officer should be permitted to pass through a grade without reasonable length of service in that grade. The objections to such forms of selection certainly so much outweigh its advantages that it will not be further considered in this article.

Limited selection is the form now in use for the line of the navy for all grades above lieutenant commander. In this form of selection, as used at the present time, no officer may be selected to fill a vacancy in any grade unless he shall have served in the next lower grade for a period of four years, two years of which must have been at sea. The wisdom of this provision ought to be apparent to all. It assures a reasonable amount of service in each grade for each officer. There may be some question as to whether the length of service required is too much or too little but it is believed that it is a reasonable compromise and

therefore not open to serious objection. In this form of promotion every officer must be selected to gain promotion to the next higher grade.

In Lieutenant Commander Vossler's article he proposes a limited selection; a selection of candidates to fill a certain percentage of the available vacancies and the filling of the remaining vacancies by promotion by seniority of those officers remaining. By this method he expects to get the best officers to the top and at the same time give every officer the certainty of promotion as a reward for length of service. As can readily be seen this method is neither fish nor fowl; it is a compromise; an endeavor to placate both the "selectionists" and the "anti-selectionists." Lieutenant Commander Vossler proposes to have these selections made by a "selection board," presumably of the same general character as the present selection board.

The writer is unable to discover any good reason for using any selection if it is not to be used entirely. It seems to me that if selection is right it should be used, if it is wrong it should not be used, but that halfway measures are simply a makeshift and cannot stand. From what can be learned, the reasons for this partial selection are based largely upon the supposedly certain injustice done to many officers by the selection boards, due to the great similarity of officers' service records. It seems to be based upon the idea that a selection board cannot properly select all the officers for promotion but can select a certain number. Just why this is, is certainly hard to see since it is the same board doing the same business in both cases. Lieutenant Commander Vossler mentions as a criticism of the present selection board that the "personnel of practically every selection board is different from the preceding one. This cannot help but result in certain changes in policy in regard to making selections, as evidenced by the fact that frequently in the past an officer rejected by one selection board has been selected by a subsequent board," etc. Would the board he advocates be any different? Would it not have an ever changing personnel?

When one comes right down to hard facts isn't it desirable to have a change in the personnel of selection boards once in a while? By doing so candidates in general are certain to have a much more characteristic board than if one set of officers served

for years, always using a set policy. Furthermore, why always assume that the promotion of an officer once passed over shows that a mistake was made by not promoting him before? It may simply be that that officer wasn't considered as good as those previously selected for promotion but that he stands high among those now available: it may indicate that he has shown a decided improvement as shown by his fitness reports, in naval parlance he may have "snapped out of it": it may be that where only a few are selected the board has exercised exactly the same prerogative it would have to exercise in the proposed selection of a small percentage only, that those previously selected were all men of "exceptional merit." One can easily think of a good many reasons why a later selection is not necessarily a mistake in itself and why it does not show with any certainty that an error was made when the officer in question was passed over. Unfortunately the average officer does not make the slightest effort to justify the selection board unless he agrees with its findings, he simply points it all out as a mistake and as a "horrible example" of what the present system does for us.

Lieutenant Commander Vossler further states that the present system fosters "more or less jealousy among officers," etc. Is it possible for any system, even seniority, to do other than foster a certain amount of jealousy among us? It is only a question of relative jealousy in any case. The writer of this article believes that the jealousy would be more acute in the case of selecting only a very few for promotion than it now is with the selection of the many. In the one case, about ninety-five per cent would be more or less jealous; in the other case, only five or ten per cent are the jealous ones. It seems that ninety-five per cent would do much more to "reduce co-operation and co-ordination throughout the service" than the five per cent. This appears to be only common sense.

The writer has heard much criticism of the various selection boards and of their methods of carrying out the unpleasant duties assigned to them. The general trend of this criticism is that through favoritism or some other illegitimate means certain persons are selected while through dislike others are passed over. Many of those who criticise believe that the board does not take sufficient care in making its selections and does not adequately

scrutinize the records of all officers available for promotion. This can hardly be the case for the law under which the selection board was created and is now operating provided very distinctly that "The report of the board shall be in writing signed by all the members and shall certify that the board has carefully considered the case of every officer eligible for promotion under this law, and that in the opinion of at least six members, the officers therein recommended are the best fitted of all those under consideration to assume the duties of the next higher grade," etc. How can one get a more binding certificate than this? To assume that all cases are not adequately considered is to impeach the integrity of the board, a thing hardly to be seriously thought of since the board is composed of naval officers of long standing and much experience. We might as well say that honesty does not exist in the service as to say that nine rear admirals would sign such a certificate without having actually carried out its requirements.

It is undoubtedly true that officers' records do not show the real differences that exist between the officers they represent. Owing to the almost uniform desire to do the square thing by every officer in the service, commanding officers are very reluctant about giving any commissioned officer an unsatisfactory report or, in fact, any report below the "very good" class. While this attitude is very commendable, it is questionable whether or not the best interests of the service are being served thereby. With straight promotion by seniority, uniformly "very good" or "excellent" marks and records did no real harm if the really inefficient officer were actually singled out and marked accordingly. There was nothing to be gained or lost (so far as the whole service was concerned) whether an officer good enough to be promoted had a record which might be classed as "good," "very good," or "excellent." It is that fact that is largely responsible for the habit we have acquired of marking everybody in the "very good" or "excellent" classes.

With promotion by selection, all this is changed. When we come to the proposition of picking the best five out of perhaps twenty officers and allowing the other fifteen to retire for age in grade, records are of the utmost importance. Commanding officers should certainly change their methods of marking and give an officer the classification that he actually deserves. The

captain of a ship almost invariably knows just about where an officer belongs in the scale of efficiency. He should see that the marks he assigns put that officer in his proper relation with others in his ship and in the service at large. Many will protest that the captain of a ship is largely influenced by local and perhaps accidental happenings and cannot give those under him a classification that will do them justice. This might be so in certain isolated cases, particularly in the case of an officer who changes duty quite often, but in the long run it is not considered very probable. The average captain or flag officer does not base his estimate of the value of an officer (more particularly one of considerable rank) upon accidental or transitory happenings; he usually sees the reasons for such accidental things and certainly bases his estimate of the real value of an officer upon his consistency of accomplishment, his conscientious performance of duty, his ability to get results, not just here and there, but all the time. It is easy enough for the commanding officer to conclude that an officer under him belongs in the upper or in the lower strata of officers (taken as a whole) when classed according to their efficiency. His judgment will seldom be wrong. We must accept the few errors that are made as the price we pay for our lack of ability to produce perfect naval officers, perfect men, or perfect judges of human character and ability.

The present "Reports of Fitness for Officers" are hardly sufficiently explicit to get the best evidence of an officer's ability or lack of ability before a board. The writer believes that they should contain some very explicit questions; such as will not permit of evasive or general answers. The following are suggested as a guide of what is intended:

1. Considering only officers of the grade of this officer:—
   How many do you know sufficiently well to mark for efficiency? .....
   Where do you place this offcer among those you know sufficiently well to so mark? .....
   How many are there under your command? .....
   Where do you place this officer among those under your command so far as his efficiency is concerned? .....
2. As a member of a selection board would you select this officer for promotion to the next higher grade? .....

If the answer to the above question is "yes," would you select him ahead of his regular turn, in his regular turn, or after his regular turn? .....

3. As a commanding officer would you desire this officer under your command? .....

If you would desire him under your command, in what position would you wish him to serve? .....

It may be suggested that it would be very difficult to answer some of the above questions, particularly those under paragraph one. This is just the thing that is intended. It is believed that those officers assigning marks should be obliged to think and figure; to stop and compare the officer under consideration with other officers of the same rank whom they know; to estimate in their own minds whether or not the officer under consideration is deserving of special consideration; in general, to use sufficient thought on the whole matter so that the record as made up will present something concrete rather than a mere statement that the officer is "average," "above average," or "below average."

A great objection to selection is based upon the fact that the members of the board do not, and cannot, know personally all or even a large part of the officers under consideration for promotion. There is some merit in this objection but hardly as much as one might think at first glance. It is granted that the members of the board probably know very few of the lieutenant commanders available for selection to the grade of commander. There is no real objection to this condition since promotion from the grade of lieutenant commander must consist mainly of passing over these officers whose records indicate that they are not up to the standard of efficiency required.

As time goes by an officer naturally becomes better known in the service so that by the time a commander becomes eligible for promotion to the grade of captain he should certainly be fairly well known to at least some members of the selection board. This will make the selection somewhat more rigid than it was from the grade of lieutenant commander to that of commander.

By the time an officer is eligible for selection to flag grade his acquaintance with members of the selection board, the sufficiency of his record, and his reputation in the service should, and probably are, matters that need little discussion. If an officer is

not quite well known by that time, if his reputation as an efficient officer is not well established, if his record (covering probably at least thirty years of service) is not sufficient for the board to establish a fair and just estimate of his ability, then there must be something so lacking in that individual's make-up that it is not unreasonable to conclude that he is hardly the man to be a flag officer in the navy.

It does not seem that there can be any real argument against selection for flag grades whatever merit there may be in objections to its use for other grades. The mere fact that there can never be more than a small percentage of officers to reach flag grades, and yet allow those who become flag officers to serve a reasonable length of time in those grades, makes it essential that only the best captains are promoted. The great difficulty is to find some means whereby the best may be secured. The present system (with certain minor modifications) seems about as good as can be devised at the present time.

CONCLUSIONS

The writer is well aware that the conclusions he draws from the above discussion will not be found acceptable to many officers. He doesn't need anyone to tell him that the present laws are very unpopular among certain officers; but he believes that the whole thing boils down to what is for the greatest good and the best interests of the navy regarded as the bulwark of national defense, not as a means whereby the governnment agrees (either in writing or by implication) to furnish satisfactory employment for any certain person or class of persons.

The writer's conclusions are:

(a) That the present laws for the promotion of commissioned line officers are generally satisfactory to the service and should not be radically changed. Certain minor modifications are desirable.

(b) That the principle of selection up is fundamentally sound and should be continued for promotion to the grades of commander, captain, and rear admiral.

(c) That an officer once passed over should be permitted to retire voluntarily in his grade on a retired pay based upon his actual length of commissioned service.

(d) That an officer twice passed over should be placed upon the retired list with graded pay at a date approximately sixty days after the approval of the recommendations of the selection board that last passed over him. He should be permitted to retire voluntarily during this sixty days should he care to do so.

(e) That reports of fitness of officers should be more in detail and should require more specific answers (especially for officers serving in grades from which promotion is by selection).

(f) That selection out should not be used in the navy.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PEACE-TIME NAVY AND MERCHANT MARINE

By Lieutenant P. V. H. Weems, U. S. Navy

During war-time emergencies the merchant marine, or as much of it as is needed by the government, is taken over, and becomes as much a part of the government as the navy itself. When the emergency subsides, the merchant ships are returned to the private owners or sold to reimburse, partially, the government for the original cost, and again the naval and merchant services become distinct and aloof. When there are no wars or rumors of wars, a narrowness of view, one service for the other, becomes apparent. The merchant service working through the labor unions hampers naval reserve legislation and displays a certain amount of narrow prejudice against the navy, due perhaps to the unfounded fear that surplus naval personnel will reduce the number of jobs available for the personnel of the merchant service. Another objection advanced by the merchant marine, in some cases, to closer co-operation with the navy, is the irksomeness of naval discipline. At the same time, through failure to realize the possibilities of service in the merchant marine, naval officers and men, with some exceptions, have decided aversions for any sea service other than that in the regular navy.

The upkeep for an adequate navy is so expensive that it becomes more and more obvious that the economics of the navy must be given due consideration by the parties responsible for the administration of the navy. For instance, how would the situation be met if it developed that the pay of navy personnel was suddenly reduced to half the amount normally expended? Would half of the personnel be cashiered? Would the quality of the personnel be lowered by giving lower salaries? Or would an endeavor be

made to hold a portion of the excess personnel in an active reserve, and constantly ready for service in the navy?

Closer and more efficient co-operation between the navy and the merchant marine is entirely possible, and would result in a financial saving to the government, though the method required and legislation needed to bring this about are not so evident. The object of this paper is to bring out some points in favor of better teamwork between the two services, and to state some facts which militate against such teamwork. The taxpayer is in no mood or financial position to pay a huge ship subsidy or to maintain an expensive navy. If by co-operation between the navy, including the coast guard and lighthouse service, and the merchant marine, the navy can become indispensable to the merchant service, and the latter made profitable, then public opinion as well as the government will be squarely behind both services.

Some of the logical results of this co-operation, if put into effect, would be a reduction of overhead costs, less duplication of operative personnel, docks and repair facilities, and greater smoothness and efficiency of radio communication. The presence of navy personnel on board merchant ships would also help to insure proper consideration when American ships are in foreign ports, which is not always the case by any means.

The average taxpaying citizen cannot see why the navy cannot be put to some other economic use than solely that of protective insurance. Doubtless many people wonder why the many naval vessels cannot at least carry fast mails and perhaps light cargo. It is also little known that legislation was brought before Congress only a few years ago to have the navy maintain a line of fast mail carriers to foreign ports. The legislation failed to pass yet it shows what might take place at any time. This idea was recently expressed in Europe for standing armies in peace-time. Mr. Richard Spillane writing about "a novel plan for the rehabilitation" of Europe, as laid before the League of Nations by an Englishman with experience in the World War, states that eighty per cent of the time of the various armies was spent on engineering construction work. The concrete idea as given by Mr. Spillane follows: "In the engineer corps of each army there is high skill. This is not utilized in times of peace for human progress and

betterment. He suggests that the League of Nations utilize its International Finance Corporation to enter into contracts with each of the European states to develop their resources, such as railways, canals, harbors, mines, forests, hydro-electric enterprises and various dormant industries, the Finance Corporation to issue bonds secured on the various public works and guaranteed by the states. The army engineers and the troops of the states should carry out the work." At first sight this might appear to be a radical scheme, yet it is a safe prediction to say that a parasitic military or naval force will be far from popular with the taxpaying citizens during the next ten years.

An item recently appeared in the press to the effect that Congress is considering the advisability of utilizing one third of the naval officers below the rank of lieutenant, in the merchant marine by having the shipping companies pay one half of the officers' salaries, and the navy pay the other half. In effect this would be a subsidy; on the other hand it would provide the nation with an active reserve ready for instant service in the navy. As a matter of fact, it also might result in preventing a shifting of personnel by having the proper navy personnel on certain merchant ships at the outbreak of hostilities. It should obviate the necessity of hurriedly enrolling numerous officers to serve on board merchant vessels as was done when the United States entered the World War.

In private conversation, many naval officers interpose some of the following objections to closer co-operation with the merchant marine: "Naval officers have enough to do to keep up with their own jobs"; "A naval officer's profession is too highly specialized to permit such diversified work"; "The navy was made to fight"; and similar arguments. Some of these points are well taken, and theoretically, most of them are correct, but these arguments will not stand careful analysis. Some of the principal duties of a naval officer come under the heads of: (1) engineering, (2) navigation, (3) seamanship, (4) international law, and (5) handling men.

A young naval officer holding down the job of chief engineer of a 10,000-ton merchant vessel running on a close schedule with half the number of men he might have been accustomed to in the navy, and this on half the allowance he had previously been

given in the navy, certainly has as favorable an opportunity to learn practical engineering as a brother officer busied with the upkeep of the engineering plant of a small naval vessel, and with the operation of this plant only when the allowance of fuel oil permits. Moreover, the merchant marine personnel are paid for overtime when worked over eight hours, and the discipline is lax. In other branches of work it is much the same proposition—less men and material to do the same work.

Captain Felix Riesenberg, in his excellent book, *The Men on Deck*, writes as follows: "The British merchant service is at the present time strongly advocating commissions, by the government, for merchant marine officers. With our Shipping Board, and with the growing control by military and naval authorities over merchantmen, some such plan might be advisable for American merchant marine officers, and would undoubtedly help to elevate the standards, and bring the naval and mercantile services into closer harmony.

"The British merchant service association are also agitating the question of some sort of standard uniform for merchant service, officers and men.

"This is a good idea, and should be adopted by Americans. The writer, however, would not advise the adoption of the naval blouse. This is the property of the U. S. Navy. . . ."

The idea expressed by Captain Riesenberg drives straight to the point, that of bringing the "naval and mercantile services into closer harmony." The layman would ask why harmony does not already exist. It is more a question of aloofness than that of lack of harmony, and this aloofness arises from various half-hidden reasons. One cause resulting in a certain amount of ignorance of one service regarding the other, is the fact that the merchant service comes under the administration of the Department of Commerce, and, as is most natural, this department shows an independence in the rules and regulations promulgated for the governing of the merchant service. Where exactly the same end is desired, and under practically the same conditions, the two government departments will employ different methods. On the other hand, it can be truthfully said that the regulations for the two services are surprisingly alike, and the differences more apparent than real. To one acquainted with the Navy Regulations,

the rules and regulations for the merchant service will seem logical, and most of the information, in different words perhaps, will already be known. The international rules for the prevention of collisions at sea, international law, and the international code, apply, of course, alike to the navy and the merchant marine. The best textbook on modern seamanship, *Knight's,* is used in both services. Many of the customs are the same for both services. Many of the engineering problems are the same. The navigational problems are much the same in practice, although the examinations for master's license requires a knowledge of the old time-sight method, courses in points, and orders to the steersman to be given with reference to the helm and not with reference to the rudder as is the case in the navy. The duties of specialists such as radio operators, might be said to be identical.

To a naval person, the hardest part of the examinations for the merchant marine is the definitions applying to the merchant service, and to the stowing of cargo, all of which the naval person should know. An evident need in the navy libraries is a comprehensive book covering the entire subject of what every naval officer should know about the merchant service, except engineering and navigation, which subjects are covered thoroughly by naval textbooks. To prepare for the master's examination, a naval officer will probably find it necessary to rummage through books on international law, naval construction, seamanship, and navigation, and finally have recourse to an encyclopedia or an unabridged dictionary, unless he contents himself with incomplete data found in the small special books usually written as a "gouge" for the examinations.

The duties in the merchant service, except purely military, are much the same as those in the navy, and contrary to the usual opinion, the laws made to maintain discipline are not unlike, if applied in the same spirit. Such crimes as piracy, barratry, mutiny, and murder are punishable as prescribed by national law. Corporal punishment has been abolished as has been done in the navy. The more common offenses with the assigned punishments are as follows:

First. Desertion, forfeiture of clothes and wages.

Second. Absence over leave, two days' loss of pay, or expenses incurred for hiring substitute.

Third. Absence without leave, one month's loss of pay.

Fourth. Disobedience of orders, four days' loss of pay, one month imprisonment, or the use of irons if necessary.

Fifth. Continued disobedience and neglect of duty, placed in irons, on bread and water, full ration every fifth day, till disobedience shall cease, loss of twelve days' pay or by imprisonment not over three months, at the discretion of the court.

Sixth. Assaulting master or mate, two years' imprisonment.

Seventh. Embezzlement or wilful damage to vessel, loss of wages sufficient to cover damage, and at the discretion of the court, twelve months' imprisonment.

Eighth. Smuggling, loss of wages to replace loss, also imprisonment for twelve months.

Taking into consideration that the first offense for navy men under eighteen is not considered desertion regardless of time absent from station, and the fact that loss of pay is remitted, subject to future conduct, the punishments for similar offenses are not altogether out of proportion. It becomes more a question of how discipline is enforced, than the means to enforce it.

To quote again from Captain Riesenberg: "The etiquette of the bridge, in the merchant service, especially on the large liners, is as formal and stiff as that on any battleship. The heights of responsibility are always on high tension. In the lesser trades, on tramps and the like, officers are more lax, though they should be no less vigilant.

"Salutes are given and returned (on the liners) and uniform is worn.

"Relieving officers should be on the bridge at least five minutes before eight bells."

The professional examination for an able seaman covers practically the same ground as the "A to Z" subjects in the *Bluejacket's Manual* for seaman first class in the navy.

It is easy for a naval officer to believe that regular line service is absolutely necessary to his successful professional career, and that service in the merchant marine would mean losing touch with the constant progress being made in the navy. The work and knowledge required in the merchant service means to the average naval officer or man eight hours of union labor per day and only

the knowledge necessary for the special work undertaken; that engineers, for example, would have no interest outside their department, and that each person would stick to one job, narrowing his view of other work. This attitude, if we are to judge of the conditions "as is" and not as they should be, is partially justified. On the other hand, it is submitted that there is plenty to learn by the merchant marine officer or man, and that a navy person serving in the merchant service would, while losing out in some lines, be the gainer in others, which would at least partially counterbalance the loss of knowledge resulting from the absence from a man-of-war.

Taking the conditions as we have found them in the navy during the past two years, service in the merchant marine would have been more active than that in the navy. For instance the navigator, engineer, and the seamen, would have had more opportunity to practice their trades because they were at sea more. There is so much more to be known to make an efficient officer than the mere routine and professional work that the varied experience to be gained in a merchant ship would prove beneficial to a naval officer. In this connection, the sea training of John Paul Jones is enlightening. At the age of twelve he had become a seaman's apprentice and made several trips to America. Later he rose to the grade of mate and finally master in the merchant service. Some of his most valuable experience seems to have been gotten while in a slave ship. Previous to entering the young American Navy, the only naval experience Jones had was a few months in the British Navy as acting midshipman, yet the lack of naval experience did not prevent him from becoming in a short time one of the greatest sea captains in our history. His better spirit rebelled against the life on a slave ship, yet he continued on in the merchant service, and in this service he killed with a belaying pin a mutinous negro in order to maintain discipline. The experience Jones gained in slave and merchant ships did not appear to have a bad effect on his qualifications as a naval officer. Another interesting case is that of the sea captain, Bucknam, who was made an admiral in the Turkish Navy.

The benefits to be gained by the merchant marine through closer co-operation with the navy would be felt some years hence rather than immediately. A great deal of prejudice, while perhaps

entirely human yet no less detrimental, would have to be overcome. Recently there appeared an editorial in the *Philadelphia Evening Bulletin* under the head of "Surrendering to Prejudice" as follows: "Dropping the naval reserve clauses from the Shipping Bill is a surrender to the prejudices of organized labor, who profess to fear that the enlistment of officers and crews of the merchant marine in the reserve service of the United States Navy would constitute an encroachment of their rights as citizens.

"Their protests are based on the assumption that the right of the government to call the reserve into service in the event of an "emergency" might he utilized for the purpose of breaking a marine strike. Chairman Lasker, of the Shipping Board, in his opening address to the House Committee disclaimed any such purpose, declared that it was intended that the bill should explicitly avoid any such contingency, and offered to accept any definite amendment to that end.

"The prejudice which prevails in organized labor against the National Guard, however, appears to have been insurmountable. Votes in Congress against the Shipping Bill were threatened, if these patriotic provisions were not stricken out. The naval reserve will be authorized in separate form.

"But why should the interests of a trade union and of a reserve for national defense, either in army or navy, be in conflict? Why should an effective reserve for national safety prejudice the rights of any man in any legitimate trade, or its organization?

"The Shipping Bill contemplated a payment, beginning at $650,000 the first year and ultimately reaching $3,000,000 per year, for the voluntary enlistment of a force expected to number 5,000 officers and 30,000 men, trained and ready for emergency naval service. What is there in that, derogatory to any right of labor?"

The interesting point in this editorial is that it shows that there is a prejudice against the closer co-operation between the navy and the merchant marine on the part of organized labor as influenced by the seamen's unions, where no such prejudice should exist. If there is any justification for this state of mind, the cause of it should be removed; if not, the unfounded prejudice should be overcome by convincing the responsible heads of the unions of their error.

A great many of the American youths who enter the merchant service do so with the idea of reaching the grade of mate or master. A successful seaman who has risen to the grade of master mariner, while wishing the just personal rights of seamen assured, would certainly be in favor of sufficient discipline to insure efficient management. After all, should not the successful man's judgment be taken as against the numerical majority who are inexperienced or ne'er-do-wells? Especially should the ideas of the more experienced men be accepted, since the ideas of the younger men, though radical and different at first, will veer round to the ideas which the older men hold. A good portion of the objectionable feature of the La Follette Act is based on undue attention to the welfare of the seaman. If the results of the law were entirely to the advantage of the seaman there would at least be one logical reason for keeping the law on the statutes, but a careful analysis will show that while the law certainly has many good points, there are also many features which are meant to benefit the seamen but really result to their disadvantage. The most conspicuous defect is the requirement for a certain minimum crew. This results in less pay and advancement for the seamen since the shipping concern will have less earnings. At first sight, by permitting fewer men to do the work, the number of jobs is cut down, but the fallacy here is that due to competition of foreign bottoms the number of ships flying the American flag is cut down with the result that the total number of jobs is ultimately reduced. If half or two-thirds of the crew are Americans, who hold the responsible positions, the foreigners in the less responsible positions would be only an economic gain to our shipping, since our surplus youths could turn to other and better jobs. The fact that fewer men are carried would not necessarily mean an excessive hardship on the men, for the manpower released is usually replaced by labor saving machinery. Besides, the biggest advantage America has is the fact that one of its men is the equivalent of two of some of the less efficient foreigners—at least they would become so, if left unhampered by restrictive laws. A good example of a purely American initiative is the method of handling the efficient 10,000-ton lake boats. With a crew of thirty-two, which would be reduced to twenty-seven or less if the law permitted, and with about six deck hands,

these fine boats come alongside a pier, load 10,000 tons of ore in as low as one hour, steam to destination and unload this cargo in as low as ten hours. These boats make regular runs and the crew are signed up for six months and in some cases practically make the ship their homes. While there are only a few men on deck they have efficient gear and winches and each man knows his job and sees it through.

The output of an American laborer is, say, twice that of a Japanese laborer. Assuming this is the case, why shouldn't 100 Americans operate a ship built with American ideas, of the same tonnage which would require 200 Japanese to operate? We certainly cannot hope to compete with a Japanese ship when a similar American ship is compelled by law to carry an equal number of men, each of whom is paid a salary twice as great as that paid a Japanese of similar rating.

By utilizing naval personnel in the merchant service a more experienced personnel would be gradually developed; the amount of graft in the merchant service would be decreased; the younger officers would have a higher average intelligence. It is by no means necessary for a merchant marine officer to be a college graduate, yet if more young men with liberal education enter the merchant marine it is sure to profit by the addition. Our ships, when in foreign ports, would be accorded more respect if officers and men from our regular navy were among the crew. Officers with naval training would as a rule be more conversant with international law, and would maintain better discipline. Naval officers would have to be broken in as regards the business end of the work, but it is believed that they would adjust themselves to the economics of the business, where this is the *raison d'être* rather than battle efficiency which is the case in the navy.

Navy personnel would take into the merchant service progressive ideas on navigation, radio telegraphy, and engineering. The navy system of sanitation and administration would supply certain points needed. On the other hand the navy would learn many points from the merchant service. Assuming that the beneficial features of operation and administration in each case would be adopted, both services would be certain to benefit by this teamwork.

An entirely possible development of the American merchant marine within the next decade will be thousands of Diesel motor ships of standard construction, manned by minimum crews, but supplied with labor saving machinery to replace the extra men, making runs similar to the efficient Great Lakes ships, and touching regularly at ports with modern terminals, and particularly South American ports. The entire foreign trade would then be centralized and made profitable by volume of trade, adequate terminal facilities, and by efficient administration, rather than by attempting to compete with foreign bottoms on the hit or miss basis of tramp trade.

It might still be necessary to make certain changes in the La Follette Act, but generally speaking, shipping will be made profitable by having markets so developed that full cargoes will be provided, and efficiently handled, making the pay of manning the ships a minor consideration. In this case there might for the time being be fewer jobs for the seafaring men, and for that reason, the change be resisted. But if the big view be taken, the labor unions will back the project, for in this way our merchant marine will be in a better position to compete with foreign bottoms, more American ships will be put in operation, and in the long run more and better paying jobs will be provided for seamen.

It will require men of particularly clear judgment to develop our shipping along these lines. The obvious first objection will be that if we run these ships there will be insufficient markets and exchange to make them pay. Here we get an excellent example from the United Fruit Line, which not only put on a line of ships but also made and developed their own markets. When the natives in the tropics failed to supply the demand in the United States for fresh tropical fruits, the United Fruit Line was not stumped; instead they bought plantations, built railroads, built their own docks, and produced tropical fruits, all with such success that they can put bananas and other tropical fruits on our breakfast tables at prices to compete with the apples grown in our own back yards.

Another objection to the big view by little men will be that we must take the conditions as we find them and not overshoot our mark. If it is correct in principle for America to keep on the seas an adequate and efficient merchant marine, then it is

submitted that we should not be content with the conditions as we find them, but rather that we should make the conditions that will react favorably to our merchant service. A large capital will be required to finance the merchant marine, but who will be better equipped for this than American financiers of the type of Mr. Schwab?

The word "subsidy" rubs the general public the wrong way, yet if it is conceded that some form of ship subsidy is necessary, then it can best be accomplished by giving the bonus another name. Taking a lesson from our brother legionaries, instead of giving our merchant marine a "bonus," why not give it "adjusted compensation"? Congress has hit upon the idea of having Naval Reserves serve in the merchant service, thus letting the navy foot part of the pay checks, and reducing the cost to the shipping concern by an equal amount. This should prove a helpful arrangement for both services provided the reserves in the merchant vessels keep up with their naval duties, and according to many persons of good judgment this can be done.

Another substitute for the ship subsidy plan is advanced by Mr. Edwin J. Clapp. "There are," he says, "potential American shipowners capable of so concentrating upon themselves the export traffic of the country that this concentration in itself would serve as a subsidy to offset their higher operating costs." The *Baltimore Sun* comments as follows on Mr. Clapp's plan: "The railroad's control of traffic gives its water line and water line extensions an advantage over any independent steamship company. Its overhead will be less than that of the independent company, because the existing agencies will take care of the water business. Every railroad agent will be a steamship agent as well. Solicitors for the rail traffic will solicit for the ship traffic. Shippers in the interior would rather deal with one transportation than two. It helps them in tracing delayed shipments and collecting claims. If the Chicago exporter can deal with one company in shipping goods to Buenos Aires he will be glad to do so, rather than to let one company handle them by rail to New York or Baltimore and another by water to the South American port. The advantages which the company will have in this respect, Mr. Clapp thinks, will compensate him for the higher costs necessitated by compliance with the American navigation laws.

"He enforces his argument by citing what the railroads have done with water lines in our coastwise traffic and, in particular, what the Canadian railways have done with their steamship lines on two oceans. Canada has conceived a national transportation policy, domestic and overseas. It would require only a slight advantage in load, a slightly heavier cargo to carry, to enable the American steamer to take the same unit rates as its foreign flag rivals, pay higher operating costs and yet make money."

Heretofore, the people of the inland states have taken little interest in the welfare or operation of our merchant marine, hardly seeing the vital relation of foreign shipping to their own prosperity through increased demands for their products. During the past decade, however, due to the war and to the publicity it gave our overseas shipping, or the lack of it, greater interest has been taken all along the line in our seaborne traffic, and to a less extent, this increased interest applies to the navy.

The farm bloc in Congress have come out in favor of a ship subsidy though condemning the practice on principle. The general public have become more interested in the efforts of our shipping interests to maintain the American flag on the sea. Chairman Lasker of the Shipping Board states that the recent cut in rates to South America made by the British Company, Lamport and Holt, can only be interpreted as "a declaration of war" in the South American trade. "The war," he says, "may be the forerunner of similar ones in other ocean passenger services in an effort to drive the American flag off the seas, but our 'hat is in the ring,' and we will stick as long as necessary to assure American domination of the passenger traffic on all oceans."

In order to get a correct estimate of intelligent public opinion, a series of questions were put to about a dozen prominent civilians and naval officers. A most obliging response to these questions shows that there is wide interest in the subject. The questions were:

(a) Is a government ship subsidy correct in principle?

(b) If so, what is the best form of subsidy?

(c) Do you consider the detail of line officers of the navy to duty in the merchant service as proposed in Congress a wise move?

(d) Would a line officer below the rank of lieutenant commander gain or lose professionally by two years' service in the merchant marine?

(e) Would the merchant service benefit by having in its employ personnel from the regular navy? (This refers both to active or reserve duty.)

There was a practically unanimous affirmative answer to (a). Mr. Irving S. Merrell makes the point that while a ship subsidy is correct in principle and necessary, the public is hardly ready to pass the necessary legislation, and that it will be necessary to enact laws giving a virtual subsidy without giving it that name. Mr. J. W. Powell writes, "A government ship subsidy for the United States is absolutely correct in principle. I am heartily in accord with the proposed Merchant Marine Act of 1922, although I should have preferred the use of discriminating duties and tonnage taxes in the indirect trade. This we could not get because of what seemed to both President Wilson and President Harding good diplomatic reasons, and the form that is now proposed should be effective in providing for the carrying of half of our commerce in our own ships. Close co-operation between the merchant marine and the navy is essential. One of the two principal reasons why we should have an American merchant marine is that it is an essential auxiliary to the navy in time of war. It can only operate effectively if the navy and the merchant marine are on excellent terms and this can only be achieved by association between the two services. Both the navy and the merchant marine would be the gainers by this association. As to the best way to work it out, there may be differences of opinion. Personally, I believe a naval reserve as part of the merchant marine comprising men who serve at stated intervals on board naval vessels, will accomplish the results in the most satisfactory way."

Most of the answers are doubtful and vague about question (b), the form the subsidy should take. As for (c) all but one answers in the negative; and almost all are opposed to (d), that line officers would gain professionally by two years' service in the merchant marine; and finally, practically all believe that the merchant marine would benefit by having in its employ personnel from the regular navy.

One rear admiral states, "I am inclined to think that it would

be to the interests of both the navy and the merchant marine if young officers could serve a certain length of time in the latter, provided this service should take place during the period they would otherwise have performed shore duty. This provision is necessary for two reasons: first, because it would be undesirable to decrease the amount of regular naval sea service; and second, because if they should do so, it would doubtless imperil their chances of promotion."

A captain gave the following logical answers: "In regard to (b), I think the subsidy should take the form of payment for speed, tonnage, and miles steamed, the principal factor being the miles steamed. Making this the principal factor would avoid paying a subsidy of any great amount to vessels idle in port and would in itself put a premium on speed. . . .

"With regard to sub-paragraph (d), if the navy is to be tied up or to do little cruising for one reason or another, the officer would gain professionally in seamanship and navigation by such employment. If the navy is to be active, I believe he would gain more by his regular duties in the navy."

One captain states, "(c) The service of line officers in the merchant marine ought to improve it; there would come about a better mutual understanding between the two services with a stronger sense of common interest; and a limited amount of such experience would benefit some line officers.

"(d) The right kind of officer would gain by added new experience. An officer who would lose would probably not profit much by any variety of experience. The Navy Department would have to see to it that merchant marine experience did not impair an officer's chances before the selection board."

One commander writing on (a), states, "The results of a strong merchant marine are twofold. The first is in the time of peace and may be called commercial. That is, instead of the American people paying out their own good money to foreigners for transportation charges they will pay it out to themselves. In this way one of the largest items in a nation's balance of trade, called 'invisible' items of the balance of trade, is created. This also is intimately connected with insurance, etc. This, therefore, is of tremendous importance to the economic health of the nation. Like the tariff, however, if the subsidy is too high, the

nation pays the price. The amount of the subsidy must be so nicely balanced that it is the result of natural economic factors, and herein lies all the dispute and arguments.

"The other result of a strong merchant marine is the effect it will have upon the resources of the country in time of war, in its relation to the navy, etc., with which most of us are familiar.

"A ship's subsidy is therefore correct in principle. Whether or not the principle is to be applied depends upon:

"(a) Economic conditions,

"(b) The nation's policies.

"(b) If applied, what is the best form of subsidy?

——"As proposed by President Harding to the present Congress. Also with the repeal of the obnoxious features of the La Follette Law."

The point most likely to be overlooked by the layman in his judgment of the navy and the merchant marine is the need of one for the other. The country needs both an adequate navy and an efficient and sufficient merchant marine; also each of these services needs the co-operation of the other. So far as the business management of the two is concerned, there should be an "interlocking directorship," the directors having equally at heart the interests of the navy and merchant marine.

An adequate navy is needed as an insurance against foreign aggression.

A sufficient and efficient merchant marine is needed:

(a) To provide a naval auxiliary is case of war,

(b) To provide a foreign market and the proper balance of trade during times of peace.

To procure an adequate navy, it is necessary for the taxpayer to pay the price, though this burden may be lessened to a small extent by combining the coast guard and the lighthouse service with the navy, resulting in reduced overhead costs; and also by having the navy work more closely with the merchant marine resulting in an indirect saving.

To insure the development of our merchant marine, the following steps are recommended:

(a) Permit our merchant marine to become centralized under big corporations, thus reducing overhead expenses, and increasing the chances of getting full cargoes.

(b) Permit and encourage railroad companies to own and operate steamship lines, as shipping agents and other railroad officials can work direct with the shipping concerns on the oceans.

(c) Change our laws so that they will permit the smallest possible crew rather than a large crew; and also give more protection to the ship operators in their relations with the crew. To obtain these changes in our laws, we must convince the labor people that it is to their own advantage to have our laws so made that our shipping can compete with foreign bottoms.

(d) Enact legislation which will provide a naval reserve operating on merchant ships, these reserves paid entirely or in part by the navy, and so adjusted that the wages paid by the shipping company will be about on a par with the wages paid to foreigners with similar ratings. This will provide at once a virtual ship subsidy and a naval reserve.

(e) Lastly, and only for the time and amount necessary, pay a ton-mile subsidy, the subsidy to be withdrawn as soon as our ships are able to meet all competition.

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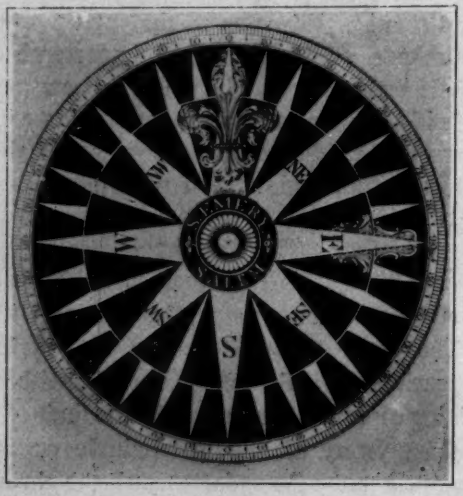
OLD NAVIGATION

By Louis F. Middlebrook

There were many early scientists who tried to figure out and manufacture instruments for the use of mariners, but their difficulties were many, probably due to their inability to devise something that would overcome the unsteadiness of a rolling, pitching craft, in addition to the lack of educational qualifications of those who would use them. The compass was quite universally used, but all of the other early and ingenious devices made and employed to determine time and position may never entirely be known on account of the perils of the sea and the wholesale destruction of the ships containing them. The advent of the printer's art stimulated various writers on astronomy and navigation to advance their theories and offer practical means to support their ideas. An occasional treatise will come to the surface even nowadays, containing methods of semi-practical importance hitherto unknown or little recognized. These works now are, of course, curious antiquities, but nevertheless form parts of the progress which has resulted in the present exactness of the navigator's profession. Up to the beginning of the fifteenth century practically no instrument outside of the mariner's compass was being used to aid navigation. The Portuguese probably did more to improve the art about this time than any other nationality, by calculating tables of the sun's declination, and improving the astrolabe. The cross-staff or fore-staff was perhaps used for many years previous to, and contemporaneous with, the astrolabe. The ascertaining of latitude seemed to be the limit of the mariner's ability and the mystery of finding longitude was unfathomable for many years after the Armada, or until the chronometer came to the rescue.

Concerning the mariner's compass, an ancient writer said: "This most useful instrument is justly ranked among the greatest wonders of the world, and deserves well to be understood by all practitioners in the art of navigation, for without the help thereof, it were impossible to trace out the unbeaten paths of the ocean for the procuring of trade and traffick beyond the seas to the remote parts of the world; whereby the glorious Gospel hath been transmitted into the most dark corners of the earth." Some historians attribute the invention of the compass to John or Flavia Goia, of Amalfi in Campania in the Kingdom of Naples, who used but eight points (four cardinal and four intercardinal) about the year 1300 and so left the improvements to posterity. Others concede the invention to the Chinese. Dr. Gilbert in his book, *De Magnette,* asserts that Paulus Venetus transported it first to Italy in the year 1260, having learned it from the Chinese. Mr. Barlow in his *Navigator's Supply* (1597) mentions personal conference with two East Indians who declared they used a magnetic needle of six inches or longer, upon a pin, in a dish of white China earth filled with water, in the bottom of which were two cross lines for the principal winds, the rest of the divisions being left to the skill of the pilots. The people of Bruges and Antwerp are credited with the perfection of the compass, and



OLD FIGURE OF MARINER'S COMPASS

also the British, by annexing twenty-four subordinate points, and also adding the 360 degrees.

The astrolabe was designed to take the altitude of the sun, moon, or stars, for calculating latitude, for determining the points of the compass, and time, and for ascertaining heights, but was not capable of precision. It was in use as early as the fifteenth century by navigators. It was probably in use by the Arabs many centuries before in the deserts and possibly on the sea. It was usually made of brass, bronze, or heavy wood of fine texture, and varied in size from two or three inches to a foot or more in diameter. The mariner's astrolabe was adapted from that of the astronomical instrument, by Martin Behaim, about 1480.

Columbus is said to have calculated his latitude by altitude of the sun taken with an astrolabe. Some of them are beautifully chased and engraved. The usual size employed by mariners was an instrument of three to seven inches in diameter and about one-quarter inch thick, of brass or copper, circular in form except at one place where there was a projection containing a hole for a ring by which it was suspended. A plumb line from the point of suspension marked the vertical line, from which were derived the horizontal line and center. The upper left quadrant was graduated to degrees. The pointer, of the same metal and thickness as the circular plate and about an inch wide and as long as the diameter of the plate, was pivoted to the center. A line was drawn across it its full length and at the ends of the line were fixed plates at right angles, each having a small hole, both exactly over the line, for sighting when suspended. It usually took three observers, one to hold the instrument, one to measure the altitude, and one to read off.

The sea-ring or "ring-dial," first produced during the early sixteenth century, was claimed to accomplish all that an astrolabe would do in finding the hour and the sun's altitude; and many similar contrivances are said to have been made and used nearly up to the time of the sea-quadrant (about 1600) and probably afterwards, until the Davis "hog-yoke" or sea-quadrant became quite universal. Up to this time all instruments in use at sea for measuring angles depended upon an unsteady plumb line or required the navigator or observer to look in two directions at once. The "ring-dial" consisted chiefly of two rings closely fitting within

From Boston Museum of Fine Arts

ASTROLABE (EARLY SIXTEENTH CENTURY)

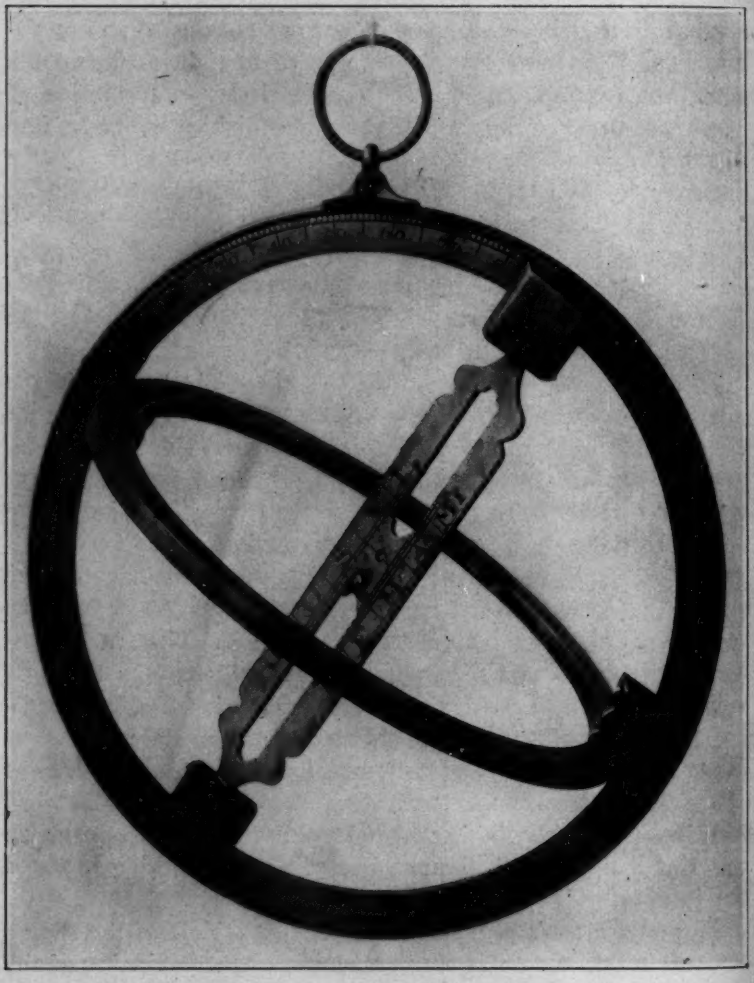
each other, and a bridge. It was made either of brass or silver. The outermost ring represented the meridian and on the foreside had one of its upper quadrants divided into 90 degrees. On the back side a semi-circle was divided into a like number of degrees from the hole or center of the circumference. On the convex edge of this ring was fitted a sliding nut with a small wire ring in it for hand suspension. This nut had a small line engraved in the middle of it to coincide with and move to any of the degrees on the fore side. The inner ring (when opened to right angles to the outer ring) represented the equinoctial circle, on the inside of which was drawn a line, and thereon were divided the hours into halves and quarters, and numbered with the proper Roman numerals on the upper side of the ring. The bridge represented the axis of the earth, in the middle of which was cut a long slit. Upon one side of the slit were engraved the months (abbreviated) and on the other side the degrees of the sun's declination. In the slit was a sliding nut crossed with a fine line division. In the middle of this nut was drilled a small hole.

To find the hour of the day by this ring-dial, the hole in the small sliding nut on the bridge was placed to the day of the month (or sun's declination) and the nut on the convex side of the outer ring was set to the degree of the place's latitude (whether north or south) on the fore side of the outer ring. The rings were opened to right angles, and then, with the instrument suspended by the fingers, the upper end of the bridge was turned toward the elevated pole, and the flat side of the bridge turned against the sun, so that its rays might pierce the little hole. Then the instrument was turned to the sun until the sun beams—by the little hole—fell exactly upon a line drawn on the inside of the equinoctial or inner ring; then was shown the hour of the day according to the capacity of the instrument. The dividing of the degrees of the sun's declination on the bridge of this instrument is ascribed to Edward Wright who is said to have been the first to contrive this ring-dial, although Gemma is credited with having invented one in 1534.

To find the sun's altitude the line in the middle of the sliding nut was set on the outer ring, to zenith, or the beginning of the degrees on the fore side of the outer ring, then a pin was inserted into the center hole on the bridge, and the dial suspended on the

finger, and the edge of the outer ring turned toward the sun so that the shadow of the pin might fall upon the divisions on the back side. The degree cut by the shadow was the sun's altitude. The use of the instrument was discontinued before 1746.

The cross-staff, or fore-staff as it was sometimes termed, was an instrument consisting of box wood, pear wood, or bethabara,



From Collection of L. F. Middlebrook

SEA-RING OR RING-DIAL, CIRCA 1600

From Colson's New Kalendar, 1746

CROSS-STAFF

about an inch square and a yard long. Degrees were graduated on the upper face. The cross was made to fit closely and to slide back and forth upon the staff at right angles. The cross was about twenty-six inches long, in each end of which were sights. Additional shorter crosses were also used. The use of the instrument was to take the meridian altitude of the sun or stars. It was generally discontinued before the time of the Davis quadrant.

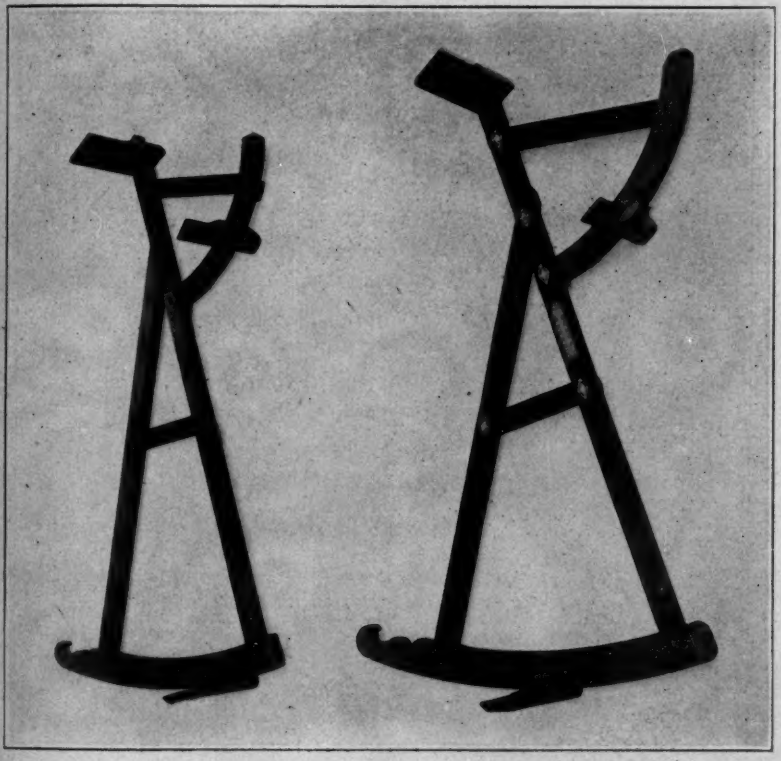
From Collection of L. F. Middlebrook

ANCIENT TIME-PIECE (SUN-DIAL AND COMPASS), BRASS CASE SCREW COVER 2″ DIAMETER

Local time was roughly obtained before and after the time of watches, by means of the pocket sun-dial and compass. This handy little instrument was quite universally used both at sea and upon land and was about the only time-piece available pending the perfection of the watch and chronometer. The hour or sand glass was of course necessary; in fact, the hour glass was used on board ships of the British Navy as late as 1830.

The celebrated navigator John Davis produced his sea-quadrant or "hog-yoke" about 1594. This instrument was made of wood—mahogany, pear wood, or ebony, and sometimes teak with the arches made of box wood. Some were highly decorative and inlaid with ivory or pearl, while others were very plain and ordinary. It consisted of three vanes and two arches: the horizontal vane, which in observing was pointed to the horizon; the shade vane, so called because of its giving the shadow upon the horizon vane when observing; and the sight vane, which was placed at the eye of the observer and through which the shadow and horizon vane were seen. The smaller arch on the end of the instrument next the horizon vane was the "sixty" arch because it was graduated to 60 degrees, and the larger arch was called the "thirty" arch as it was marked for 30 degrees, this arch being divided into degrees and minutes. When observing, the shade vane was shipped upon the "sixty" arch always to an even degree, the arch being numbered from the upper end downward. The instrument was used to take the sun's meridian altitude. The horizon vane being shipped on the end, the shade vane on the "sixty" arch to a number of degrees less than the complement of the altitude by 15 to 20, the sight vane ready on the "thirty" arch—then, with the back to the sun, the sight vane placed to the eye, observation was made so as to cause the shadow of the upper edge of the shade vane to fall upon the upper part of the slit in the horizon vane, where there was a black line. If the horizon vane appeared through the slit, that was the sun's altitude, but if it did not appear, the sliding sight vane was shifted on the "thirty" arch until it did show. By adding the degrees of the "sixty" arch to the degrees and minutes thus found on the "thirty" arch, the sum was the complement of the meridian altitude. If the sun's meridian was south, and the declination north, the declination added to the zenith distance was the latitude north. The declina-

tions were already worked out and tabulated as well as the variations of declinations to every 15 degrees of longitude from the meridian of London in a handy "Kalendar" or nautical almanac. The Davis quadrant remained in common use until superseded in 1731 by John Hadley's quadrant, and Davis' instrument was used in many instances by those accustomed to it even as late as the Revolutionary War. Edward Wright devised a sea-quadrant about 1599 similar to the Davis quadrant, but it required two persons to use it, and was therefore not as popular or practical on an unsteady ship.

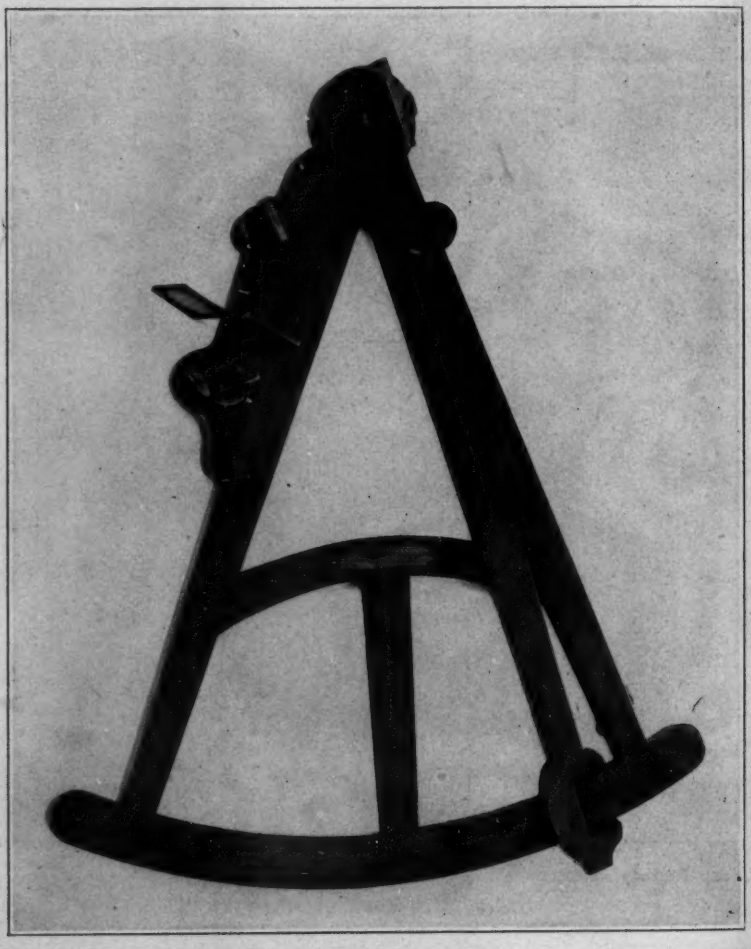


From Peabody Museum

DAVIS "HOG-YOKE" QUADRANTS

John Hadley probably made his first octant in the summer of 1730. It was tried out in 1732 by order of the Admiralty, found satisfactory, and was made and quite universally used by mariners

for many years, or until the sextant replaced it. The invention of the sextant is credited to Thomas Godfrey, of Philadelphia, in November, 1730. Clocks were probably invented about 1480 and watches about 1530; then it was that they were used for finding the difference in longitude between two places by comparison with local time. But they were inaccurate and not relied upon until about 1735, when the chronometer was developed to be an almost

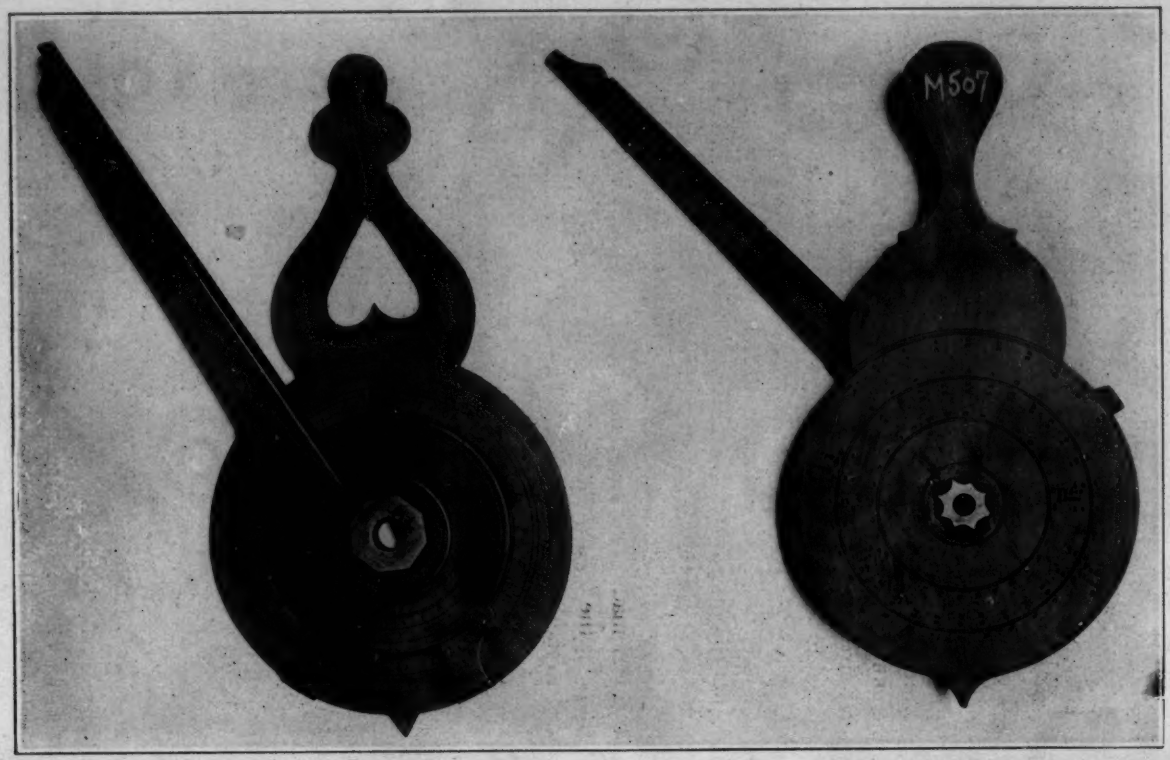


Owned by Mr. Morgan B. Brainard

HADLEY QUADRANT INSCRIBED "MR. ISAAC SEYMOUR 1769"

perfect time-keeper. Thus John Hadley's octant, the chronometer, and the sextant, all invaluable instruments, were invented at nearly the same time.

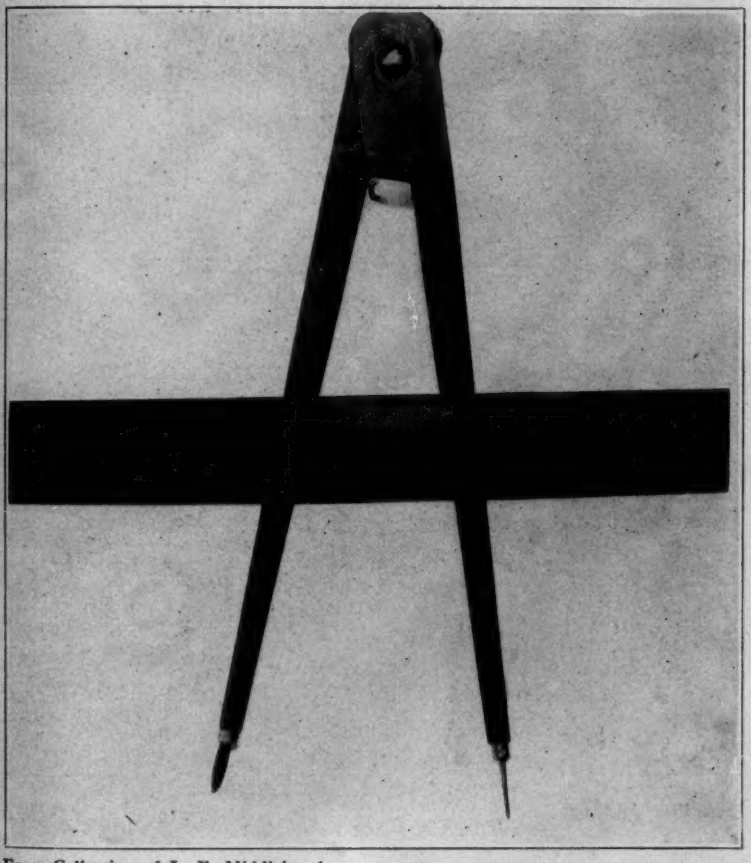
The nocturnal was an auxiliary instrument (usually made of apple wood, pear wood, or box wood) for the purpose of telling time at night. It was in use, as records show, as late as 1750. It consisted of three parts. The largest or immovable portion, with a handle, had the outer circle divided into twelve months and subdivided into days; each division was marked with the names of the months. Some of them were more elaborate and contained another circle with the marks of the hours and still another circle graduated to 29½ parts or the days of the moon's age, by which the moon's southing might be known and thereby a computation made of the tides. There were three kinds of nocturnals. One made for the guard of the little bear, one for the guards of the great bear (or pointers), and one for both bears. If the nocturnal was made for the little bear, the twenty-first of April would be at the top. If made for the great bear, the seventeenth of February would be at the top. If made for both bears, there would be two indices on the inner or movable part. The back side of the largest or immovable part was divided into thirty-two points of the compass to show the bearing of the guards and thus indicate what declination the north star had upon any point of the compass. The inner, or movable part, if nocturnal was made for both bears, contained two circles and the indices, one marked "G" for great bear, and the other marked "L" for little bear. The outside circle was divided into 29½ days for the moon's age and the inside circle into twenty-four hours, graduated to quarters. The index belonging to the bear intended to be used was set to the day of the month in the outside immovable part, at pleasure. The third part was a long index or handle usually made of box wood, the edge of which was to be turned to the guards or pointers at the time of observation. To find the hour of the night and at what points of the compass the guards were, the index of the middle part was set to the day of the month, the instrument being held upright, then a sight was taken through the hole in the center, for the north star. When found the edge of the long index was turned to the guards or pointers when the edge of the handle



From Peabody Museum

would give the hour on the outside edge of the inside circle. The invention of the nocturnal is credited to M. Coignet, in 1581.

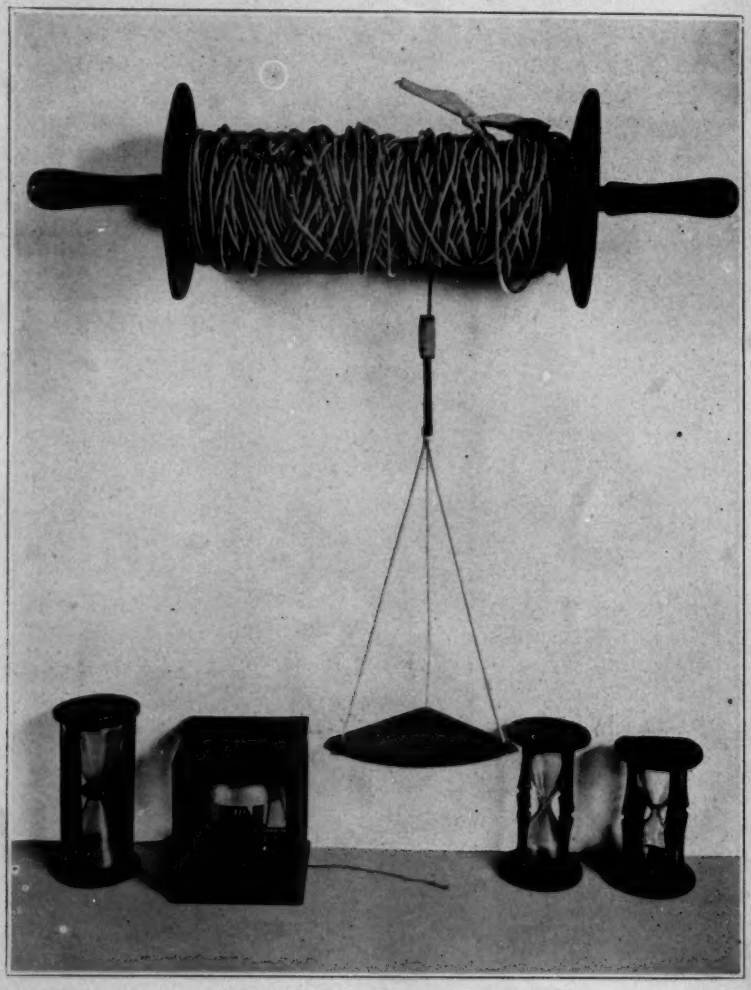
Edmund Gunter, in 1624, supplied tables of sines and tangents applied to navigation, and invented the sector and the Gunter's scale—usually two feet long and about two inches wide and engraved with various lines and numbers. On one side appeared the cords, sines, tangents, rhumbs, etc., and on the other corresponding logarithmic numbers. Multiplication, division, and questions in navigation were solved by the aid of a pair of compasses on this scale. Perhaps it was the ancestor of the slide rule.



From Collection of L. F. Middlebrook

SECTION OF THE GUNTER'S SCALE AND OLD WOODEN COMPASSES, 1816

The log-chip is a device for finding the rate of the ship's speed. It commonly consists of a triangular piece of wood curved at the bottom and loaded so that it will float upright in the water. It has a radius of about six inches and is about one-quarter inch thick.



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TOP, CHIP-LOG AND LINE

LEFT TO RIGHT, 14-SECOND GLASS, EARLY NINETEENTH CENTURY; DEVICE FOR DETECTING SMALL PORTIONS OF TIME, 1830; LOG GLASS FROM C. S. A. SHIP "FLORIDA," 1864; OLD 28-SECOND GLASS

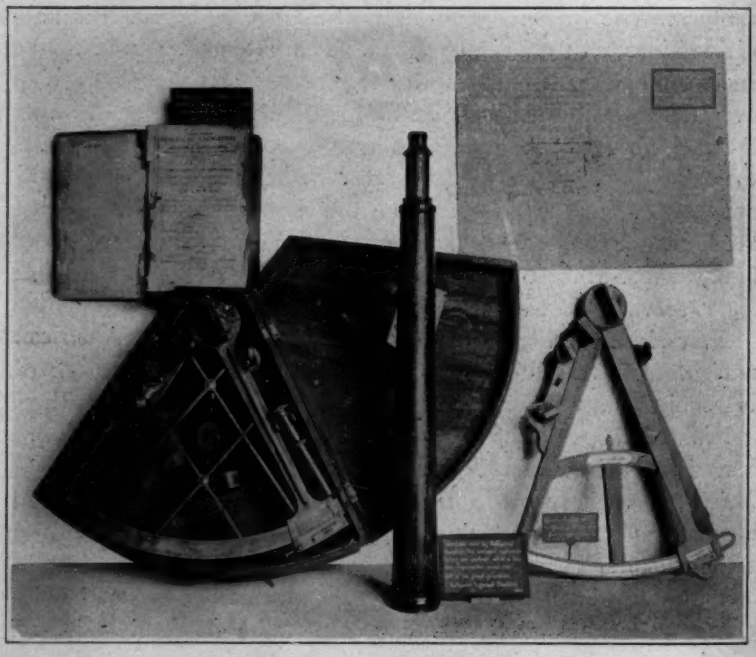
To the corners cords are attached connecting with the log line which is wound around a reel, the axis of which projects, allowing it to turn freely when held by the hands. The line is long enough to measure the distance sailed by the ship at her greatest speed during a given time, usually thirty seconds, and is divided into knots corresponding to a proportional part of the nautical mile, that is fifty-one feet; in some cases it is made a trifle longer or shorter. The string is knotted at such places that the spaces bear the same relation to a nautical mile of 6,070 feet (or 1/60th of a degree of latitude) that a half minute does to an hour—that is, the knots must be the 120th of a nautical mile apart. Each knot is therefore 50-75/120 feet. A certain length of line, not marked, intervenes between the chip and the first division of the line. This is called the "stray-line" and allows the chip to drift beyond the dead water to the wake of the ship. Each knot on the line is made sensible to the feeling as well as to the sight and is subdivided into ten fathoms, so-called. The time is measured by the small sand glass. In heaving the log the observer throws the chip over the taffrail and when the first mark on the line passes over the reel, he calls out "turn" to his assistant, who at once inverts the sand glass. When the sand has all run out, the assistant calls out "up," when the observer stops the running of the line, noting the knots and fathoms which have passed out. This done every hour, as well as the compass course steered, is entered in the ship's log to serve as a basis for the "dead-reckoning."

Ever since the beginning of the nineteenth century American navigators have quite generally followed the standard work of Nathaniel Bowditch as their "dictionary" in matters maritime.

Nathaniel Bowditch, the American author on navigation, was born in Salem, Mass., March 26, 1773, and died in Boston in March, 1838. He made his first voyage in 1795, as clerk, and later as supercargo; and in the course of five long voyages, rose to be master. Harvard conferred upon him the degree of M.A. and offered him a professorship of mathematics, which he declined, as he also did a similar offer from the University of Virginia and the United States Military Academy. He was admitted as a Fellow of the Royal Society of London. He produced his first edition of the *Practical Navigator* in 1801, which was printed in Newburyport, Mass., as were also other editions, and

Bowditch's Navigation, coupled with *Luce's Seamanship,* have practically formed the standards which have been established and authorized as the fixed rules and measures for American mariners.

The sextant shown with the Bowditch relics, is a universal reflecting instrument used for measuring angles on shipboard. It resembles the quadrant, but has an arc of 60 degrees. Ancient Arabian astronomers are said to have had a sextant of 59 feet 9 inches radius, about A. D. 995. Sextants are used to obtain altitudes of celestial objects in order to obtain latitude and local time, and longitude. It is an improved form of quadrant and is capable of measuring angles of 120 degrees. It consists of a frame, generally of metal, stiffened by cross braces and equipped with convenient handle. The arc is divided into double the number of degrees actually embraced between the two extreme



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THE NATHANIEL BOWDITCH RELICS

First Edition, 1801, *Practical Navigator*

His Sextant Spyglass Quadrant

graduations, as the fixed and movable glasses, owing to the double reflection, only form with each other an angle equal to one-half the angular distance between the two objects observed, one of which is seen directly, and the other by reflection from the index glass. In observations the sextant is held perpendicularly to the horizon. In taking noon sights at sea for latitude the observer takes his place shortly before noon, and turning down one of the colored glasses, to prevent the eye being injured by the glare, directs the sight tube to the sun, moving the index so as to bring the sun's reflected image to coincide with the sea horizon. As the sun rises he gradually advances the limb, clamping it, and using the tangent screw for this purpose as the sun's path becomes more nearly horizontal, and slightly rocking the instrument from side to side to insure that it is in a vertical plane at the moment the sun attains its greatest height. The reading on the limb at the moment the sun begins to dip is noted, and adding the declination derived from the nautical almanac to the true zenith distance obtained by observation, gives the latitude. Sights for local time are taken when the sun is rising or falling most rapidly. The calculations for this are more complicated. When ascertained, it is compared with Greenwich time, as shown by the ship's chronometers. The difference of time turned into arc at the rate of four minutes of time to one degree of arc, gives the longitude of the place.

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DERIVATION OF MATHEMATICAL FORMULAE FOR VOLUME AND CENTER OF GRAVITY OF A PROJECTILE

By H. M. Brayton, M. E.*

One of the principal important features of the design of a projectile is the proper location of its center of gravity. Everyone at all familiar with ordnance design knows that unless the center of gravity of a shell or shot is correct it will not carry properly in flight and the whole law of exterior ballistics falls down.

It is therefore highly necessary that the projectile designer know how to calculate this point accurately. As far as the writer knows no simple relation has ever been worked out for the center of gravity of the ogive, that is the pointed part of the shell at the front of the section where the nose curvature starts. The ogive is formed by an arc of a circle in practically all shell. Some armor piercing shot have been designed with special curves like the cycloid. This discussion will deal only with the general shape formed by the rotation of half of the segment of a circle about the cord.

In order to obtain the center of gravity of an ogive it is also necessary to calculate the volume of the ogive. The calculation of the volume is also very necessary in shell design in order to predict the weight. The following calculations will deal only with the finding of the volume and center of gravity of the ogive part of the shell as the remainder of the projectile is of simple shape and the formulae for this part can be taken from any handbook or worked out readily by any draftsman.

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Three methods of calculating the volume of an ogive will be given. The designer may choose the one which best fits his data or which he finds most convenient to apply. Two of the methods are without the use of the calculus, and the third uses calculus.

FIRST METHOD WITHOUT CALCULUS

The reader will now kindly refer to the sketch of Fig. 1. It is a well-known theorem enunciated by Pappus that the volume generated by an area rotated through 360 degrees about a line in the same plane but not cutting the area is equal to the area multiplied by the distance traversed by its center of gravity. If

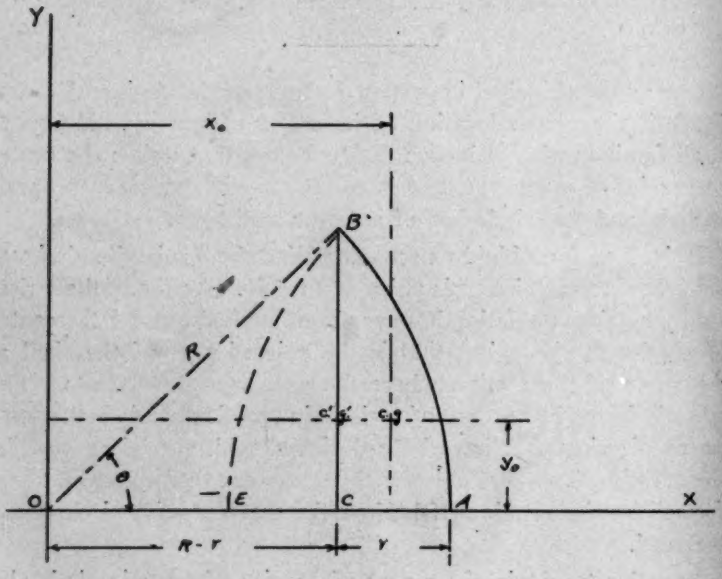


FIGURE 1

then in Fig. 1 we can find the center of gravity of the area A.B.C. which is half of the segment of a circle and also the area of this half segment we can calculate the volume formed by the complete rotation of this area about the line BC. This would form a shell ogive with radius of ogive of R and radius of shell r.

We shall now proceed to find the center of gravity of the circular half segment A.B.C. To do this we shall refer it to the regular X and Y axes as shown.

Let the center of gravity of half segment A.B.C. $= X_o Y_o$
Let the center of gravity of sector O.A.B. $= X_s Y_s$
Let the center of gravity of triangle O.B.C. $= X_a Y_a$
Let area of half segment A.B.C. $= A_o$
Let area of sector O.B.A. $= A_s$
Let area of triangle O.B.C. $= A_a$

We can take moments about both the X and Y axes of these three areas remembering that the moment of the entire area is equal to the moment of its parts thus,

$$A_s X_s = A_a X_a + A_o X_o$$

and

$$A_s Y_s = A_a Y_a + A_o Y_o$$

These two equations can be solved thus,

$$X_o = \frac{A_s X_s - A_a X_a}{A_o}$$

$$Y_o = \frac{A_s Y_s - A_a Y_a}{A_o}$$

We also know from the sketch in Fig. 1 that,

$$S = R\,\theta,\ A_s = \frac{R\,S}{2} \text{ therefore, } A_s = \frac{R^2\theta}{2}.$$

We also know,

$$\text{Cos. } \theta = \frac{O\,C}{R}, \text{ therefore } OC = R \text{ cos. } \theta.$$

$$\text{Sin. } \theta = \frac{B\,C}{R}, \text{ therefore } B.C. = R \text{ sin. } \theta.$$

and,

$$A_a = \frac{B\,C \times O\,C}{2} = \frac{R^2 \text{ sin. } \theta \text{ cos. } \theta}{2}.$$

$$A_o = A_s - A_a = \frac{R^2\,\theta}{2} - \frac{R^2 \text{ sin. } \theta \text{ cos. } \theta}{2}.$$

Therefore,

$$A_o = \frac{R^2}{2}\,(\theta - \text{sin. } \theta \text{ cos. } \theta.)$$

From the triangle O.B.C. we know that,

$$X_s = \frac{2}{3}\,O.C. = \frac{2}{3}\,R\cos.\,\theta.$$

$$Y_s = \frac{1}{3}\,B.C. = \frac{1}{3}\,R\sin.\,\theta.$$

From the sector O.B.A. we know that,

$$X_s = \frac{2\,R\sin.\theta}{3\,\theta}.$$

$$Y_s = \frac{2\,R\,(1-\cos.\,\theta)}{3\,\theta}.$$

From the above data we may write,

$$X_o = \frac{\frac{R^2\,\theta}{2}\times\frac{2\,R\sin\theta}{3\,\theta} - \frac{R^2\sin\theta\cos\theta}{2}\times\frac{2\,R\cos\theta}{2}}{\frac{R^2}{2}\,(\theta-\sin\theta\cos\theta)}$$

$$Y_o = \frac{\frac{R^2}{2}\times\frac{2R\,(1-\cos\theta)}{3\,\theta} - \frac{R^2\sin\theta\cos\theta}{2}\times\frac{R\sin\theta}{3}}{\frac{R^2}{2}\,(\theta-\sin\theta\cos\theta)}$$

The two formulae for the co-ordinates of the center of gravity of the spherical half segment can be greatly simplified and come down to,

$$X_o = \frac{2\,R\sin^2\theta}{3\,(\theta\sin\theta\cos\theta)}. \qquad \text{(Eq. 1.)}$$

$$Y_o = \frac{R\,(2-3\cos\theta+\cos^3\theta)}{3\,(\theta-\sin\theta\cos\theta)}. \qquad \text{(Eq. 2.)}$$

From the sketch it is evident that,

$$\theta = \cos^{-1}\frac{R-r}{R} = \sin^{-1}\frac{\sqrt{2\,R\,r-r^2}}{R}$$

The co-ordinates of the center of gravity of the circular half segment are given by the formulae of equations 1 and 2. In our problem we are not interested in the value of Y_o but only in the

distance from the center of gravity to the line B.C. about which we must rotate the area to obtain the volume. This distance is,

$$X_o-(R-r)=X_o-R+r$$

The volume of the ogive formed by rotating through 360 degrees the area A.B.C. about the line B.C. is then,

$$V=A_o\,2\pi\,(X_o-(R-r)).$$

Substituting known values,

$$V=\frac{R^2}{2}\,(\theta-\sin\theta\cos\theta)\,2\pi\left(\frac{2\,R\sin^3\theta}{3\,(\theta-\sin\theta\cos\theta)}-(R-r)\right)$$

Simplifying,

$$V=\pi\,R^3\left(\frac{2\sin^3\theta}{3}-\cos\theta\,(\theta-\frac{\sin 2\theta}{2})\right)\quad\text{(Eq. 3.)}$$

Equation 3 will then give the mathematically exact volume of the ogive whose radius of shell is r inches and radius of ogive R inches. The volume is of course expressed in cubic inches when R and r are in inches. Should there be any occasion to use R and r in feet units the volume would, of course, be in cubic feet. The value of θ is, of course, expressed in radian measure. To convert from degrees to radians we merely multiply the angle in degrees by II/180. The value of the angle θ is expressed as stated above by,

$$\theta=\cos^{-1}\frac{R-r}{R}.$$

It will thus be observed that this formula for volume of ogive involves only two variables R and r. θ can be procured from these two values also and from θ the values of sin θ and sin 2θ may be taken from any trig-table.

As a check on this formula for the volume of an ogive it is interesting to note the result when R and r are equal, that is, when the ogive becomes a hemisphere. If we substitute R=r we have that $\theta = 90° = \text{II}/2$ radians. Then $\cos\theta = 0$ and $\theta = 1$. Substituting,

$$V=\pi\,R^3\left(\frac{2\times1}{3}-0\right)=\frac{2\pi\,R^3}{3}$$

which, as is well known, is the volume of a hemisphere.

The formula given in equation 3 is very easy and accurate of application. Good accuracy can be obtained when the calculation after substitution is performed by a slide rule. This is because all of the terms come small for all practical values of R and r: If absolute accuracy is required the indicated multiplication and division must of necessity be done by hand.

SECOND METHOD WITHOUT CALCULUS

A second method of the volume determination of an ogive of a shell without calculus has been devised by Major J. H. Woodberry, Ordnance Department, U. S. A., at Frankford Arsenal as follows:

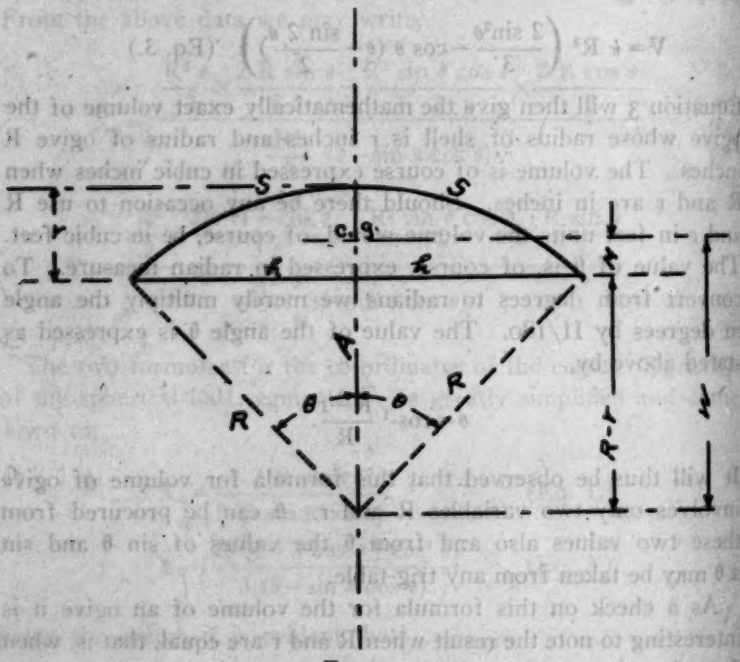


FIGURE 2

The reader should now refer to the sketch of Fig. 2. This sketch shows a complete segment of a circle the length of arc of which is 2S. The length of the cord is 2h. The radius of curvature is R and the height of segment r representing the radius of the shell.

We shall also bring in the theorem of Pappus as stated above in this derivation. If we draw from the extremities of this segment to the center of the circle, thus completing a sector, we have three regular figures—a triangle, a sector, and a segment. Then,

Area of sector $= A_s = R\ S$
Area of Triangle $= A_a = h\ A$
Area of Segment $= A_o = A_s - A_a = R\ S - h\ A$.

From any handbook we obtain the center of gravity of a circular segment to be a distance W from the center of the circle and,

$$W = \frac{(2\ h)^3}{12\ A_o} = \frac{2\ h^3}{3\ A_o} = \frac{2\ h^3}{3\ (R\ S - h\ A)}$$

Then $M = W - (R - r) = W - A$

Then by the theorem of Pappus the volume formed by the rotation of this area A_o about the cord is,

$V'_o = 2\pi\ M\ A_o$

Substituting,

$$V'_o = 2\pi \left(\frac{2h^3}{3\ (R\ S - h\ A)} - A \right) \quad (R\ S - h\ A)$$

simplifying,

$$V'_o = \pi \left(\frac{4\ h^3}{3} - \frac{6\ A\ R\ S}{3} + \frac{6\ h\ A^2}{3} \right)$$

But this volume V'_o is the total volume generated by the entire segment and the volume of the ogive would be just half of this. Hence the volume of the ogive V_o is given by,

$$V_o = \frac{V'_o}{2} = \pi \left(\frac{2\ h^3}{3} - A\ R\ S + h\ A^2 \right) \text{ (Eq. 4)}$$

This formula for the volume of an ogive is mathematically exact but it involves S, h and A. All of these can readily be found, however, with only R and r known as follows,

$A = R - r$ (in inches).
$\theta = \cos^{-1} \frac{R - r}{R}$ (in radians).
$S = R\ \theta$ (in inches. θ must be in radians).
$h = \sqrt{R^2 - (R - r)^2} = \sqrt{2R\ r - r^2}$.

Although this formula is exact it is not nearly as accurate as the one given in equation 3 because unless one carries out all of the indicated multiplication and division by hand, a huge error will be present due to the fact that the terms in the brackets all come large, usually four-place numbers. These terms come nearly equal, that is, the difference will only be a two-place number, and as an ordinary slide rule is only accurate to two and three places, a large error can very easily be present. It is very tedious to calculate so much by hand and often the desired accuracy does not warrant this effort. The formula in equation 3 is much to be preferred for rapid work.

VOLUME OF OGIVE BY CALCULUS

Still a third formula for the volume of the ogive of a projectile may be obtained by the application of the calculus. The reader should now refer to the sketch of the front end of a shell shown in Fig. 3. Note the position of the origin of rectangular co-ordinates in relation to the projectile. The circle of the surface of the ogive is struck about the origin as a center. The equation of this circle referred to the exes X and Y is,

$$X^2+Y^2=R^2$$

or,

$$Y=\sqrt{R^2-X^2}$$

From the sketch,

$$Y_o=Y-(R-r)=\sqrt{R^2-X^2}-(R-r)$$

Now if we take an elementary slice through this ogive as shown on the sketch perpendicular to the axis of the shell and of thickness dX assuming the distance of this slice from the Y axis as X we can write the formula for the volume of this infinitesimal slice dV thus,

$$dV=\pi\, Y_o^2\, dX$$

Substituting the above value for Y_o we have,

$$dV=\pi\left(\sqrt{R^2-X^2}-(R-r)\right)^2 dX$$

Integrating this equation between the base and point of the shell or between X—h and X—O we have,

$$V=\pi R^2\int dX-\pi\int X^2\,dX-2\pi(R-r)\int\sqrt{R^2-X^2}\,dX+\pi(R-r)^2\int dX$$

$$V=\pi R^2X-\frac{\pi X^3}{3}-2\pi(R-r)\left(X\sqrt{R^2-X^2}+R^2\sin^{-1}\frac{X}{R}\right)$$

$$+\pi(R-r)^2X\Big)_{X=0}^{X=h}$$

Substituting limits,

$$V=\pi R^2h-\frac{\pi h^3}{3}-2\pi(R-r)\left(h\sqrt{R^2-h^2}+R^2\sin^{-1}\frac{h}{R}\right)+\pi(R-r)^2h$$

(Eq. 5)

This formula while no more complicated than the others has the same objection as the formula given in equation 4 namely that no accuracy can be obtained with it by using a slide rule. The angle whose sine is $\frac{X}{R}$ must be expressed in radians. The value of h the height of the ogive is the same as given above or,

$$h=\sqrt{R^2-(R-r)^2}$$

It is interesting to note in this formula as in the others the result when R = r = h and we have a hemisphere. As R — r is zero the two last terms are zero and the volume becomes $2/3\pi R^3$.

THE CENTER OF GRAVITY OF THE SOLID OGIVE

If the reader will kindly be referred again to the sketch of Fig. 3, and the elementary slice of width dX, it will be apparent that

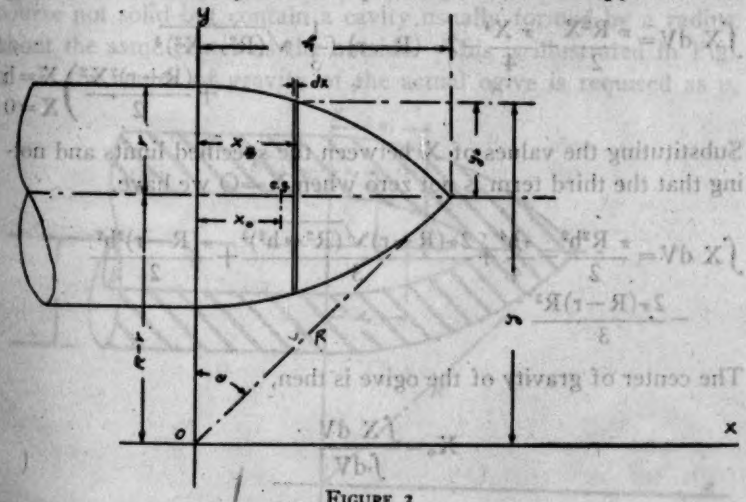


FIGURE 3

by means of the calculus we can obtain the location of the center of gravity of this mass. The center of gravity of a solid is expressed by the differential equation,

$$X_o = \frac{\int X\, dV}{\int dV}$$

where X_o is the distance from the base of the ogive to the center of gravity. The denominator of this fraction is the same as we have just calculated from the volume. Hence it is the volume and we do not have to calculate its value integrated again.

In the above discussion of the volume by calculus we showed that

$$dV = \pi\, Y^2{}_o\, dX$$

and that

$$Y_o = \sqrt{R^2 - X^2} - (R - r).$$

Hence,

$$\int X\, dV = \pi \int X \left(\sqrt{R^2 - X^2} - (R - r) \right)^2 dX$$

$$\int X\, dV = \pi\, R^2 \int X\, dX - \pi \int X^3\, dX - 2\pi\, (R - r) \int X \sqrt{R^2 - X^2}\, dX + \pi\, (R - r)^2 \int X\, dX$$

Integrating between X=h and X=O we have,

$$\int X\, dV = \frac{\pi\, R^2 X}{2} - \frac{\pi\, X^4}{4} - 2\pi\, (R - r) \left(\frac{1}{3} \sqrt{(R^2 - X^2)^3} + \frac{(R - r)^2 X^2}{2} \right) \Bigg]_{X=0}^{X=h}$$

Substituting the values of X between the specified limits and noting that the third term is not zero when X=O we have,

$$\int X\, dV = \frac{\pi\, R^2 h^2}{2} - \frac{\pi h^4}{4} + \frac{2\pi (R - r) \sqrt{(R^2 - h^2)^3}}{3} + \frac{\pi (R - r)^2 h^2}{2} - \frac{2\pi (R - r) R^3}{3}$$

The center of gravity of the ogive is then,

$$X_o = \frac{\int X\, dV}{\int dV}$$

or,

$$X_o = \frac{\frac{R^2h^2}{2} - \frac{h^4}{4} + \frac{2(R-r)\sqrt{(R^2-h^2)^3}}{3} + \frac{(R-r)^2h^2}{2} - \frac{2(R-r)R^3}{3}}{R^2h - \frac{h^3}{3} - 2(R-r)\left(h\sqrt{R^2-h^2} + R^2\sin^{-1}\frac{h}{R}\right) + (R-r)^2h} \quad \text{(Eq. 6)}$$

Unfortunately this formula can not be solved with a slide rule with the proper degree of accuracy. The value of h in terms of R and r can be substituted if desired but it is the writer's belief that it is better to solve first for h and then substitute its value in the above formula for the center of gravity.

It is interesting to note as a check on this formula that when R = r = h and we have a hemisphere we obtain,

$$X_o = \frac{\frac{R^4}{2} - \frac{R^4}{4}}{R^3 - \frac{R^3}{3}} = \tfrac{3}{8}R$$

which is the distance of the center of gravity of a hemisphere from its base.

CENTER OF GRAVITY OF ENTIRE SHELL

Thus far we have discussed only the method of finding the volume and center of gravity of a solid ogive. Most ogives are of course not solid but contain a cavity usually formed by a radius about the same center as the outside. This is illustrated in Fig. 4. If the center of gravity of the actual ogive is required as is

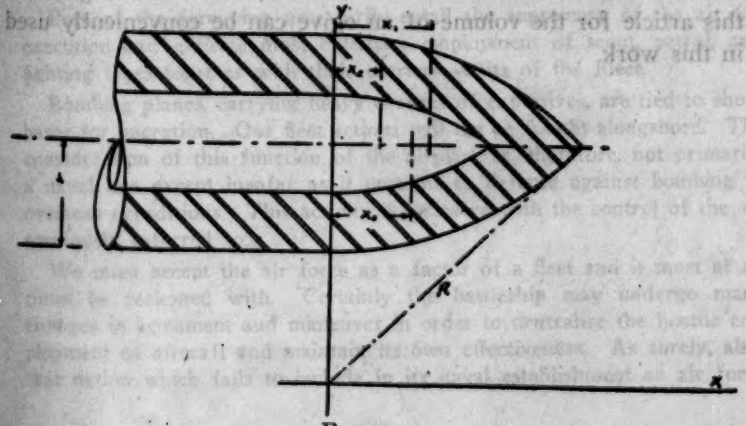


FIGURE 4

usually the case we must apply the formula given in equation 6 twice, once to the entire solid ogive, and again to the hole as if it were solid. Assume the center of gravity of the solid shell ogive at a distance of X_1, and that of the hole if it were solid at X_2, then by taking moments about the base line we can get the distance of the center of gravity of the actual hollow ogive from,

$$V_o X_o = V_1 X_1 - V_2 X_2$$

therefore,

$$X_o = \frac{V_1 X_1 - V_2 X_2}{V_o} \qquad \text{(Eq. 7)}$$

The center of gravity of the rest of the shell can be obtained usually merely by inspection, and then the center of gravity of the hollow shell as a whole can be obtained from the general formula,

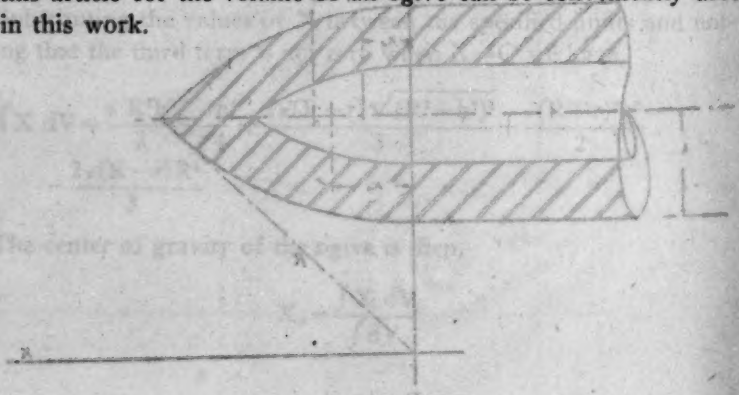
$$X = \frac{V_1 X_1 + V_2 X_2 + V_3 X_3 \text{ etc.}}{V}$$

or,

$$X = \frac{\Sigma V X}{V}$$

Plus is used in the above formula if the volume is a solid mass and minus if a hole.

The ogives of most shell especially of the larger caliber are formed by forging or nosing-in as it is called. Before the nosing-in dies can be made a lay-out must be made on the drawing board to determine where the metal will flow to, and what the interior radius will be when the shell is finished. The formulae given in this article for the volume of an ogive can be conveniently used in this work.



DISCUSSION

Employment and Tactics of Aircraft in Naval Warfare

(See Whole No. 234, Page 1263)

Captain W. T. Cluverius.—Commander Jackson's comprehensive paper is a timely contribution to the much needed inter-service education in this new and vital agency of warfare.

In the expression of opinion by those of the service afloat there is danger incurred both in magnifying and in underrating the rôle of aircraft in naval operations.

If too much is claimed then the future of the capital ship is jeopardized and all effort is likely to be directed toward the upbuilding of an air force and of little else. No naval officer has yet expressed a professional belief that the experience of the World War or the test attacks subsequently conducted by aircraft against ships as targets have sounded the knell of the battleship and that it has been supplanted by the plane.

Similarly, if the value of aircraft is underestimated there are two risks involved. One, that no further development of this energy which has been proved to be essential will obtain; the other, that no modification in fittings or design will enter into future battleship construction wherewith to combat the employment of aircraft by the enemy.

The author of the paper in question is believed to be entirely correct in holding the opinion that the airplane is a most important adjunct of the Fleet. But the adjunct it must remain and perform always auxiliary functions.

These may be summarized in (a) the service of security and information and (b) the employment in fire control.

Both of the foregoing necessarily entail the supremacy of the air for execution and indicate most extensive employment of scout, patrol, and fighting types together with their carriers—units of the Fleet.

Bombing planes, carrying heavy charges of explosives, are tied to shore bases for operation. Our fleet actions will not be fought alongshore. The consideration of this function of the airplane is, therefore, not primarily a naval one except insofar as it pertains to defense against bombing in overseas expeditions. This activity is inclusive with the control of the air previously referred to.

We must accept the air force as a factor of a fleet and it must at all times be reckoned with. Certainly the battleship may undergo many changes in armament and maneuver in order to neutralize the hostile employment of aircraft and maintain its own effectiveness. As surely, also, that nation which fails to include in its naval establishment an air force

capable of accomplishing the outlined functions will face defeat at the hands of the nation that does do so.

In the most recent example of international conflict, the chief rôle of the navies of the maritime powers at war was safeguarding the transportation to and maintaining in the theater of land operations the troops engaged.

No matter what agency was employed in so doing, the surface of the sea was the reference of all activities. Submarines and airplanes contributing to the success of such movements were concerned alike with what went on upon the surface, that is, with the transport. In the transport was located the soldier whose presence at the scene of action was eventually to influence the outcome of the war. All else was incidental, no matter how important.

Assuredly the reference will continue to be the surface of the sea until something else can supplant the transport—a surface ship—in the carriage of the vital cargo. If that something else comes to be a huge plane capable of transporting ten to twelve thousand troops in one passage with lightning-like rapidity through the air, then the reference of all that is essential to the Navy's share of hostilities does shift to the air. The air force immediately becomes the paramount issue: *it* is the Fleet.

Then, and only then, is the battleship doomed.

To the most ardent progressive in the Navy and to the most advertised propagandist in the Army I put the question:

Will *we* see this come to pass?

I ask you.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

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PROFESSIONAL NOTES

PREPARED BY

LIEUTENANT COMMANDER F. W. ROCKWELL, U. S. NAVY

and

LIEUTENANT COMMANDER J. B. HEFFERNAN, U. S. NAVY

GENERAL ARRANGEMENT

VESSELS BUILDING, NAVAL POLICY, MATÉRIEL, PERSONNEL, MERCHANT MARINE
- Great Britain 1783
- France 1787
- Japan 1791
- Germany 1792
- United States 1795

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GREAT BRITAIN

BRITISH NAVAL POWER.—It is a matter for satisfaction that the Government, after pressure from the naval Members of the House of Commons, have agreed to send the Battle Cruiser Squadron of the Atlantic Fleet to Rio de Janeiro for the centenary of Brazilian independence. There has not been a representative armored squadron sent abroad since the war, and to have omitted to send one in reply to such an important invitation as that from Brazil would have been tantamount to an admission that we have relinquished our position not only as first naval Power, but as one of the leading sea Powers. Among other occasions of late years when squadrons have gone abroad mention may be made of the visit to the United States in 1905 of the late Marquis of Milford Haven, in command of the Second Cruiser Squadron. In 1908 Rear-Admiral Sir Percy Scott took a similar squadron to South Africa during the convention which brought about the union of the States there, and subsequently crossed with the squadron to South American ports. As Sir Percy himself says in his memoirs, after describing this visit, "showing the flag occasionally in a splendid fighting squadron like this is in fact more effective than when it is seen every day in a small craft of no fighting value." In the following year the Hudson-Fulton celebrations in America led to an international gathering of warships at New York, at which this country was represented by a cruiser squadron headed by the *Inflexible*, then new, flying the Union flag of Admiral of the Fleet Sir Edward Seymour. Since then, however, the White Ensign has not been flown under peace conditions by armored ships of corresponding importance on the other side of the Atlantic.

Although in point of numbers the British vessels at Rio will not equal those of America and Japan, yet in the *Hood* we have a ship which represents the last word in completed capital ships of post-Jutland design. Not only is the *Hood* now the largest man-of-war in the world, with a

displacement of 41,200 tons, as compared with the 32,600 tons of the American *Maryland*, but as long as the Washington Treaty is adhered to she must remain so, for the latter imposes a tonnage limit of 35,000. The American vessel, however, has a somewhat heavier armament of eight 16 in. and fourteen 5.5 in. guns, as compared with the eight 15 in. and twelve 5.5 in. guns on the *Hood*, and she is, moreover, much better protected. It is an interesting fact that of the 14 ships mentioned as likely to be present at Rio, apart from those of Brazil herself, no less than seven have been built in this country. America is sending the *Maryland*, *Nevada*, *Arkansas* or *Utah*, battleships, of which the last-named is at present in European waters as flagship of the Vice-Admiral Commanding. Japan will be represented by the battleships *Idzumo* and *Iwate* and the cruiser *Asama*, all of which were built at Elswick, being launched in 1900, 1899 and 1898 respectively. Argentina will send the *Moreno* or *Rivadavia*, both American-built battleships, while Chile will send the *Almirante Latorre*, the Armstrong battleship which served in the war as the *Canada*, being present at Jutland. Portugal will contribute either the *Republica*, cruiser, or the *Carvalho Aronja*, sloop, the latter being originally the British *Jonquil*. There is certainly some satisfaction to be gained from the fact that British warship constructors will be so largely represented in such a gathering. That Japan should be content to send such old vessels is rather surprising, for it makes the representation of the three leading sea Powers nothing like the ratio of 5-5-3 for Britain, America and Japan adopted at the Washington Conference.

From the standpoint of our naval *personnel*, such cruises as that which Rear-Admiral Sir Walter Cowan is to make are very valuable, for, as the Americans discovered long before the war, they afford opportunities for giving ships' companies on the home station a sight of foreign ports, thereby increasing the attractiveness of the Navy to recruits. If it were not for the expense it would be good policy to have such cruises periodically, but as things are the Admiralty cannot take it upon themselves to add this extra cost to the Navy Estimates. Yet, on the other hand, it is a question whether the country would not gain in the long run, for it is a well-known axiom that trade follows the flag. France has recognized this in deciding to send a flying squadron, composed of the *Victor Hugo*, and *Jules Ferry*, under Rear-Admiral Gilly, on a nine months' cruise to the Far East to push French trade.—*Army, Navy, and Air Force Gazette*, 5 August, 1922.

OFFICIAL VIEWS OF SERVICE AFFAIRS.—

Naval Air Pilots

Captain Guest (to Viscount Curzon): "Pilots working with the Royal Navy are interchangeable with those working on other duties, as it is considered necessary to give them the widest possible experience. A certain amount of special practice work is needed in connection with co-operation with the Fleet, and pilots so engaged are, as far as possible retained in their appointments for a period of four years; though in practice, on account of promotion, or owing to their being required for special appointment, or for some other similar reason, the full period is not always served by all officers. Changes between pilots working with the Royal Navy and those working with the Royal Air Force in other areas have been made. Two pilots borne in H. M. S. *Argus* have been changed during the current year. One of these was required for a course at the Royal Air Force Staff College, and the other for experimental work."

Air Force Reserve

Captain Guest, (to Viscount Curzon): "The statements which have appeared in the Press recently to the effect that a new Air Force Reserve

was being created are not quite accurate. The position is that officers who were granted short service commissions in 1919 for a period of three years' service on the active list, followed by a period in the reserve, will commence to pass into the reserve this year. The first officers will be transferred in September. The reserve is intended to provide for the requirements of the air force at a time of national emergency, including the duties of the air force in connection with the Royal Navy. A number of the pilots who are at present serving on short service commissions, and who will in due course pass into the reserve, are fully trained and experienced in naval work. The reserve also includes observers. It is considered that the annual training provided for under the scheme will be sufficient to keep pilots and observers in training to carry out any air force duties which they may be called upon to perform, including duties in the squadrons of the Royal Air Force attached to the Royal Navy."

Air Force Research

Captain Guest (to Lieutenant-Colonel More-Brabazon): "No new barracks are being constructed for the Royal Air Force in the Isle of Grain. I know of no naval barracks in the near neighborhood except at Sheerness, which is situated on the other side of the Medway to Grain. The river at this point is more than a mile wide and it would, therefore, not be economical to accommodate Royal Air Force *personnel* on that side of the river. The total provision made in the Air Estimates for carrying out research work is £1,147,000. This figure represents the sum which is devoted to all forms of experimental and research work carried out under the direction of the Air Ministry, and into this work enters a very substantial element of pure research, the cost of which it is not possible to extricate from the remainder of the vote. It also includes a sum of £47,000, which is specifically confined to pure research work carried out at the National Physical Laboratory, at the Air Ministry Laboratory, and by the Aeronautical Research Committee, the Ordnance Committee and Research Department at Woolwich, and other joint establishments, and also by special consultants."—*Army, Navy, and Air Force Gazette*, 5 August, 1922.

ADMIRALTY ACCOUNT OF TORPEDO AEROPLANE ATTACK ON FLEET.—In view of the unauthorized and inaccurate reports which have appeared in the Press with regard to the torpedo aeroplane attack on the Atlantic Fleet, which took place off the Isle of Wight on July 7, in the presence of H.M. the King, the Admiralty consider it desirable to issue the following brief statement of the facts:

The exercise was in no sense novel, and was designed as a spectacle rather than as a critical experiment. Similar exercises have been carried out on several occasions during the past three years, and the results on July 7, only confirmed previous experience.

In order to afford practice to the torpedo aeroplanes, the Fleet approached to within a few miles of the aircraft base in broad daylight at low speed on a pre-arranged day, and at an hour signalled in advance to the aircraft. There was, therefore, no surprise attack, and the conditions were essentially unwarlike and unreal.

Moreover, as is unavoidable in all peace exercises, the Fleet offered an unresisting target to the aircraft, whose attack was undisturbed by any counter-offensive action, whether by the interference of Fleet aircraft gunfire from the light-cruiser and destroyer screens, or heavy, medium, and anti-aircraft gunfire—combined with splash barrages—from ships in the battle line.

The aircraft were thus allowed to develop to the full their offensive, while the Fleet was debarred from defending itself in any way. In spite of these favorable conditions, the number of hits obtained on the battle-line was small and of minor tactical importance.

Throughout the operation the pilots of the attacking aircraft showed skill and dash in the handling of their machines, but, as already indicated, the conditions were so unreal that no practical lessons affecting the security of the Fleet can properly be deduced from these exercises.—*Naval and Military Record*, 26 July, 1922.

AERIAL TROOP TRANSPORT.—An improved aerial troop transport, with a hull of tubular steel large enough to accommodate twenty-five soldiers and their equipment, has been ordered by the Air Ministry under the recently announced £2,000,000 expansion scheme to provide 500 machines for home defense.

Other orders call for planes constructed entirely of metal, weighing fifteen tons each; big multi-engined bombers and single-seated metal fighters of great speed.—*Boston Evening Transcript*, 29 August, 1922.

AEROPLANES FOR NAVY.—There are 127 service aeroplanes in active commission engaged in exercises with the Navy, and a total of 359 aeroplanes for all purposes connected with the Navy.

These facts were announced by Captain Guest (Secretary for Air) in reply to questions in the House of Commons yesterday week.

The Minister was asked by Viscount Curzon whether any of the machines working from or with H.M.S. *Argus* had recently crashed, and how many aeroplanes were available for service working with the Royal Navy on July 16, for bombing, fighting, torpedo carrying, observation, and training respectively.

Captain Guest replied that since May 15 last only two aeroplanes had been seriously damaged and written off during deck practice. Damage to aeroplanes was to be expected in training exercises of this kind, but this did not affect the number of aeroplanes available, damaged machines being at once replaced from the supply held in immediate reserve.

Aeroplanes were available in the following numbers, including the 50 per cent first line reserve, which was kept at the unit and provided immediate replacements for any damaged or unserviceable aeroplanes:

Reconnaissance—18 ship planes, 18 float planes, 15 flying boats.
Spotting—18 ship planes.
Torpedo carrying—18 ship planes.
Fighting—9 ship fighters.
Training—9 float seaplanes, 12 flying boats.
Development—6 flying boats, 4 torpedo ship planes.

Thus there were 127 service aeroplanes in active commission and first line reserve engaged in aerial and naval peace exercises or in naval air training and development. In addition, two of the reserve squadrons, comprising 36 aeroplanes, including immediate reserve, were inter alia being used for certain other special forms of naval co-operation.

Finally there was maintained behind these units a main reserve of the various types amounting to over 200 aeroplanes without pilots, all of which would be available for the reinforcement of the above naval units.

The actual grand total of aeroplanes for all purposes connected with the Navy was 359, exclusive of the two reserve squadrons.—*Naval and Military Record*, 26 July, 1922.

FUTURE OF THE DOCKYARDS.—The reduction of the Royal dockyards is now approaching completion, according to an official statement, and it is expected that discharges will soon cease. This is good news for the localities concerned, which have suffered severely during the past three years. At the same time disturbing rumors as to the fate of Sheerness have been set at rest by the assurance that there is no intention of closing down that establishment. It remains to be seen, however, whether the reductions effected to date will satisfy the economists, who have been

urging a more drastic process of demobilization. Pembroke has escaped suppression only because of the abnormal state of unemployment in the country, and a return to better conditions may be followed by the closing of the Welsh yard, which the Admiralty do not consider to be essential to future requirements.

With the fate of Pembroke still undecided it is particularly unfortunate that work recently executed there should have shown such a large excess of cost over the original estimate. The country has had to pay £180,000 more than the estimated price for completing three vessels, only one of which is a fighting ship, and this loss, so the Admiralty declare, must be attributed mainly to inadequate output of work by the Pembroke staff. If there are many other instances of this kind, Parliament will certainly demand a review of the whole question of dockyard maintenance. The future of Woolwich Arsenal is also receiving attention, and in our last issue we gave particulars of a scheme which has been under consideration for some time past. It is to be hoped, however, that no further experiments in State competition with private industry will be sanctioned after the egregious failure of the locomotive building project. Moreover, apart from questions of economy, the further development of Woolwich as a war arsenal is open to grave objection on strategical grounds because of its exposure to air attack. The proposal to create a new State arsenal at Gretna has been dropped for reasons of economy, and also because of the opposition it encountered from Labor interests. Nevertheless, the fact must be faced that Woolwich has become a most unsuitable locality for a great national arm depôt, and that money spent on developing it in this respect will be money wasted.

This problem of readjusting Government dockyards and arsenals to peace requirements is not confined to Great Britain. It is proving exceptionally difficult across the Channel, where the dockyard interests command a great deal of political power and have contrived so far to evade retrenchment on anything like the scale which it has reached here. When the size of the respective fleets is taken into consideration it will be found that the French marine budget is burdened far more heavily than our own by expenditure on shore establishments. Competent authorities estimate that the French dockyard personnel could be reduced by one-half without in any way prejudicing naval efficiency. Apparently, however, the Government considers it impolite to attempt any such sweeping cut.

The same question came up in the United States last month during the debate on the Naval Appropriation Bill, when a resolution was tabled urging the appointment of a committee to investigate the possibility of abolishing useless navy yards and stations. Senator King said that these now numbered four hundred, of which one hundred and fifty might be done away with at no loss of efficiency. It certainly seems an extraordinary total, even when the great extent of coastline is remembered. On the whole, we probably pay less for dockyard administration in proportion to our naval power than any other country in the world.—*Naval and Military Record*, 26 July, 1922.

FRANCE

FORTHCOMING MANEUVERS: REVISED CHARACTERISTICS OF THE NEW SHIPS.—The Salaun fleet, comprising the 24,000-ton *Bretague*, *France*, and *Paris*, the 4,500-ton and 27-knot *Strasbourg* (Admiral de Caqueray), *Metz*, and *Mulhouse*, and eight large destroyers, will be this week off the Brittany coast for the purpose of carrying out combined maneuvers, on new lines, with the Northern Squadron (Admiral Lequerré) and defensive organizations, thus reversing pre-war conditions, when the rule was for the Brest division to join the Medeterranean Fleet for yearly "grandes

manœuvres navales," which points to a vast change in the naval strategy of France. Formerly, fleet action was the sole aim and end of maneuvers; to-day, action is being divided into aerial and submarine attacks, mining ambushes, long-range bombardment, camouflage and decoying practice—a more varied and interesting program.

The plans of the ships ordered this year have all been revised and improved and, in some cases, full designs will not be completed for a few months to come. The 8,000-ton cruisers will mount eight guns of 6.2 inches (155 mil., a new caliber superior in range to the 194 mil. now in service) in thick armored turrets. In the matter of all-round defensive qualities, against either gun or submarine explosions, it is considered no rival cruisers can compare with these new *Duguay-Trouins*, that will be faster at sea than all other ships of superior or equal gun power. They will develop 30,000 h.p., more than the fine British *Hawkins*. Similarly, the 2,500-ton *Jaguars* will carry six long caliber 4.7-inch guns (120 mil. tested in the course of the war, and twice as powerful as the 4-in. guns in service). Compared with the remarkable ex-Boche *Amiral Sénès*, they will be about equal in range, better armed end-on, and will possess superior defensive qualities more stability, more fire endurance and higher speed at sea. They will easily outclass the fine Italian scouts of the *Leone* and *Aquila* classes, of smaller size and inferior robustness. The 12 destroyers of the *Cyclône* series will have a normal displacement of 1,425 tons, and be armed with four 4.7-inch weapons and two 16-pounders.

Strange to notè, the fine 8,000-ton cruisers meet with some opposition in the service. They will cost an enormous sum (75 million francs), that would be better employed, it is contended, in submarines and bombardment avions. The construction of these cruisers to spread over several years is held to have for *raison d'être* the wish to give nominal employment to the 30,000 Bolshevist workmen of the State arsenals that will long continue to be a millstone round the neck of the Marine Francaise. In the Senate, as well as in the Chamber, a strong movement is on foot to urge the discarding of large cruisers and, instead, the wholesale manufacture of aerial and submarine mosquito weapons, that can be made ready in a few months' time and are adapted to France's geographical needs, as well as to the requirements of the actual political situation.

Moreover, attention has been called to a signficant move by the Italian Admiralty that is revealing itself as a thoroughly efficient and go-ahead body, free from those many red-tape letters that paralyze Rue Royale. For the two 8,000-ton cruisers of the 1922 program the Italian Marine Minister wants to substitute four destroyers, six submarines, and 70 seaplanes, of which 10 are to be heavy bombardment machines. From M. Raiberti's recent letter to the Mayor of St. Nazaire it looks as if the French Navy would need to change her methods before being in a position to outdo Italian yards and factories.

Strenuous war training is going on in the North under Rear-Admiral Lequerrè, who is proving himself an energetic man of action, ever at sea, studying the various aspects of the problem of coastal defense. It is expected the appointment of the active Admiral Barthes in command of the Channel front will have for effect to give new life to Channel mimic warfare, as the shore fixed and mobile gun batteries, together with coastal aerial squadrons, will join in the fray more than they have done hitherto. Yet, it will be agreed that Dunkirk, where Admiral Barthes has his headquarters, is hardly the right place from which to exercise the effective command of the Brittany and Normandy coast, the same as Dover in England must be said to be geographically ill-adapted to look after the naval interests of Cornwall and Devonshire. So, in practice, M. Barthes will simply have, as effective duties, to superintend defensive preparations in Pas-de-Calais and Flanders. He will do at leisure what

the gallant Admiral Ronarch did under the pressure of war. Moreover, the naval and mercantile revival in Bocheland, the creation on Dutch territory of German seaplane factories, together with the defensive alliance with Belgium, are bound to confer additional importance on the Dunkirk strategic point *d'appui*.

It is also amusing to note, in these times of economy and retirement talk, that the sole result, up to now, of the Guist'hau Coastal Defence Scheme has been to add to the number of ports-militares. Dunkirk, Marseilles, Algiers, where Commanders-in-Chief Barthes, Ames, and Varney are to officially reside become de factor ports-militaires each counting two flag officers, captains, and army colonels and their numerous staffs of attached officers and red-tape employés. There will naturally be important batteries of naval guns and super-cannon, with the necessary scouting and bombardment seaplanes, and as coastal defences without sea-going craft would be like an army without infantry, there must be ships, and ships in adequate number, attached to those new bases, which represent a good lot of matériel and personnel, and no small increment of the naval expenditure.—J. B. Goutreau, in *The Naval and Military Record*, 26 July, 1922.

COMMAND OF THE WATER: COMBINED MANEUVERS OFF BRITTANY: FRENCH OPINION CONCERNING THE WASHINGTON NAVAL LIMITATIONS.—The word "revolution" has often been used in relation to naval warfare, but never more truly than at the present moment, when in all great navies experiments are being made with new weapons and tactical devices claimed to throw into obsolescence all armaments now existing. These changes, now in the making, are the twofold result not only of war teachings but also, and chiefly, of post-war aerial and scientific progress generally, with the consequence that the former criteria of relative naval strength are becoming worthless, as are also former methods of training for war. Speed and range are the determining factors that govern tactics and armaments, and it is a sad fact that the mighty but cumbrous and slow line of battleship is being left behind, if not aside, and that to-day the best brains in the world in Germany especially, are being centered on producing the largest and swiftest aerial fighting machine. Thus to-day Admiralty experts are vying with our reputed constructors, Brequet, Bleriot, Farman, in bringing to life the most powerful "hydravion de bombardement." and no wonder. In a certain sense, the bombing quadruplane (1,100 h.p.), and the 1,800 and 2,500 h.p. naval biplanes now undergoing tests at St. Raphael and elsewhere are more important to France than the splendid 8,000 ton cruisers just ordered. The latter represent the hope of to-morrow—three years hence—whereas the former are the certainty of to-day, it being easy to multiply their number in a few weeks' time and to throw them against any aggressor, with trained crews and their complement of bombs on board.

Even in Admiralty circles the number is fast growing of experts who see, in the large armored bombing and torpedo plane, the only reliable instrument of the command of the water in European seas and who genuinely believe that, by multiplying such weapons in the naval stations that border the North Sea, Channel, Atlantic, and Mediterranean, France has in her hands the means of more than retrieving economically and promptly, the naval rank which she lost through sacrificing her navy to the Allied cause in the course of the Great War.

Although fleet action is being prepared for in the good old style, and the sinking of the *Prinz-Eugen* by the *Bretagne* speaks of efficiency, the actual Toulon squadron is felt to be too weak to be at all worthy of France and to weigh much in the balance so far as high sea operations are concerned. Besides, the various phases of maneuvers of Brittany have shown that gunships have no chance to approach undetected within

striking power of an enemy coast, and still less chance to escape without heavy losses out of all proportion with the damage they might expect to inflict. Of course, Admiral Salaun had no seaplane-carrier such as exists in the British and American fleets, and for this reason, only limited conclusions can be drawn from the failure of his attacks on Brittany. Bombardment is by no means a thing of the past. Seaplane-carriers and also submarines of the British *M* type will, in future wars, bombard coasts with impunity, and even great inland centers having industrial (that is military) importance will be liable to swift destruction by bolts from the blue. The question which the maneuvers have yet to demonstrate is the effective radius of action of coastal organizations. Time, up-to-date matériel, and more active training on a wider scale are needed before sanguine dreams become reality.

If French *amour-propre* and sense of fairness still revolt against the Washington limitations, French naval opinion is not far from considering them as a blessing in disguise, and even if the Chambers should decide, on the motion of Député de Grandmaison, to vindicate the sovereign rights of France in what concerns her naval policy (which is highly probable), the Washington affair will still have done good in contributing to altogether change the basis of sea power and to render obsolete, and utterly so, those fine super-Dreadnaughts of pre-war designs which Great Britain, Japan, and America have constructed at great cost since 1914, and which France chose not to complete (*Normandie* class). It has compelled the Paris Admiralty to reconsider its shipbuilding policy, to examine with greater care than ever before the case for the aerial and submarine weapons, and to definitely drop the twenty battleship program, on which Député Chappedelaine had already reported favorably. And, considering anew those 35,000 tons *cuirassés* in the light of recent scientific progress, Paris experts have thanked the gods that they were not ordered and laid down as had been at first intended. Unanimous opinion seems to prevail as to the inadequacy of the 35,000-ton Panama Canal limitation to meet the several new defensive desiderata to which battleship designers must give satisfaction, if capital ships are to serve more useful purposes than those of extremely costly and vulnerable targets. The realistic experiments with new shells and bombs in the *Thueringen* at Gârves and in the *Prinz Eugen* in the Mediterranean, the easy way, especially in which turrets and funnels were wrecked, together with the powerlessness of 12-inch steel plates to withstand at fighting ranges the onslaught of post-war projectiles, have, after a series of researches and laboratory tests, led Paris experts to the conclusion that all existing battle fleets are (technically speaking) non-warworthy and out-of-date, and that, when armor-piercing, poisoning, and blinding projectiles and bombs, and also torpedoes and mines, have been duly provided against in battleship designs, it is found impossible to obtain a fast (and with new systems of motors) and powerfully-armed battleship under 50,000 tons, and even that high figure would not permit all points to be met, would not give *le cuirassé ideal* capable of surviving, for instance, the aerial attacks, most deadly of all (on paper), and of safely muddling through the Jutlands of to-morrow with the many surprises they have in reserve. The turret system notably calls for radical changes, and interesting innovations are rumored in this respect.—J. B. Goutreau. in *The Naval and Military Record*, 16 August, 1922.

FRENCH NAVAL LOSSES IN THE LATE WAR.—Paris, Aug. 7.—The losses of the French Navy in personnel during the war have just been officially announced. The total losses of the Navy in co-operation with the Army amounted to 2,449. The losses at sea totalled 8,888, of whom no fewer than 1,498 are reported as having disappeared.—*Naval and Military Record*, 16 August, 1922.

LOSS OF THE FRENCH BATTLESHIP "FRANCE." Paris, Aug. 28—The Minister of Marine exonerated Captain Guy from blame for the loss of the battleship *France*, at the entrance of the Bay of Quiberon. According to witnesses, the ship was in the right course and the chart gave a depth of sixty feet, but on account of the rock reef it was less than thirty. An attempt will be made to raise the ship, as one point of the dreadnaught is only about six feet under the surface at low tide, but little hope is held for the success of salvaging it on account of the powerful currents coming out of the bay to the Atlantic.

Paris, Aug. 28 (By the Associated Press).—The loss of the dreadnaught *France*, which foundered on the rocks of Quiberon Bay, Saturday morning, reduces the country's first naval line by one-seventh of its fighting strength and places the French navy on an equality with Italy's. It will be long before former superiority can be re-established, as the dreadnaught, which cost 40,000,000 francs to build, will cost about 200,000,000 francs to replace at to-day's prices.

The vessel will be replaced by one of similar type. The naval agreement, signed at Washington, gives France the right to replace any unit lost by accident.

Public regret finds some compensation in the coolness and bravery shown during the disaster, worthy the finest records of the French navy. Not a man left the ship before the admiral commanding the squadron, who was fully informed of conditions by wireless, ordered evacuation. The operation was carried out without confusion and methodically.

The first officer to leave by the commandant's order was a steward carrying the muster roll, cash and the ship's papers. Soon only staff officers remained aboard; they were thrown into the sea as the dreadnaught, whose list had been steadily gaining, rolled over a few minutes after 4 o'clock.

Captain Guy, commanding the *France*, was completing his final voyage; he had been slated for promotion to rear admiral. Captain Guy commanded a torpedo flotilla in these waters during the war.—*Boston Evening Transcript*, 28 August, 1922.

London, Aug. 30—England, it is learned officially, has turned a deaf ear to intimations from the Continent that the loss of the French battleship, *France*, last week, might be used as means of shifting the ratio established by the Washington conference for capital ships. According to reports reaching London the loss of the French ship threatens to become an issue between the French and Italian Governments and the attitude of England is therefore important.

Under the Washington treaty France is entitled because of the loss of its dreadnaught to replace the vessel immediately and "the regular replacement program is deemed to be advanced to that extent." The reason the question intimately concerns Italy and France is because neither of those two countries has any post-war capital ships built or building.

It is reported, therefore, that if France adds a post war ship to her fleet, Italy also wishes to ask for a reopening of the other question under chapter three of the Treaty which provides for an amendment by agreement. The suggestion made to England was that the presence of two ships in the Medeterranean might affect her interests, but the Admiralty says there is no reason it can see for any change in the present arrangements.—*Boston Evening Transcript*, 30 August, 1922.

JAPAN

LOSS OF THE JAPANESE CRUISER "NIITAKA." Tokio, Aug. 30.—The Japanese cruiser *Niitaka* went down in a typhoon off the Kamchatka coast August 26, with virtually all hands, according to confirmed advices received by the Admiralty. The naval report said that practically none

of her crew of 300 was saved. The destroyer *Maki* has been ordered to the scene of the disaster.

The *Niitaka* is a second-class cruiser of 3,420 tons displacement, launched in 1901.—*The Baltimore Sun*, 31 August, 1922.

SEEK AID FOR SHIPPING.—Kobe, Japan, Aug. 10—"The Government seems deplorably without any fixed policy towards the ever declining shipping enterprise of the empire, since the restoration of peace. If the country would maintain its position as at present among the world's Powers in this line of enterprise, more positive efforts should be made by the authorities for the improvement of the situation."

This is the resolution passed by a general meeting of ship owners. The meeting appointed a committee of nine who will shortly approach the Government authorities in Tokio with the above resolution.—*Boston Evening Transcript*, 31 August, 1922.

GERMANY

NO SIGNS OF GERMAN NAVAL REVIVAL.—The French papers continue to express concern at the possibility of a German naval renascence, preparations for which, they declare, are already in full swing under cover of an ingenious system of camouflage. M. Lefevre claims to possess detailed information on this point, but apparently his details are considered by the Allied authorities to be either incomplete or not sufficiently serious to warrant such action as would unquestionably be taken were it proved beyond dispute that Germany was evading the naval clauses of the Peace Treaty. Inquiries made in circles which ought to be well-informed have failed to elicit any confirmation of these French reports. On the contrary, the story of secret submarine construction in German shipyards is dismissed as a fairy tale. One very circumstantial rumor of this kind was traced to its source and found to have originated in the fact that the hulls of discarded *U*-cruisers were being used in the construction of oil-tankers. There is every reason to believe that an exact record of all the submarines that were built or building in Germany at the date of the armistice was obtained by the Allied control officers, and that the ultimate fate of every one of these craft is known. As regards the building of any new *U*-boats since the armistice, this would have been impossible without the cognisance of the control authorities, whose methods of inquiry and supervision have been far more searching than the French Press seems to realize.

Owing to shortage of funds the active fleet is still below the strength authorized by the Peace Treaty, both in personnel and material. New construction is limited to one 5,600-ton light cruiser, which is building or about to be built at Wilhelmshaven. Tactical maneuvers are occasionally held in the Baltic, but these are circumscribed by the necessity of economising fuel. Several vessels of the fleet will soon become valid for replacement under the age clause, but it is improbable that funds will be voted for this purpose in the near future. In short, Germany is not only virtually disarmed at sea, but shows no desire to rehabilitate her naval forces even within the permissible limits. For the time being she is devoting her main effort to the building up of her mercantile fleet, and with remarkable success, judging by the latest statistics from Lloyd's.

When the Treaty of Rapallo was concluded between the German and Soviet Governments there were reports of a secret protocol providing for military and naval co-operation. Germany, it was said, would undertake the reorganization of the Russian arsenals and dockyards, and then proceed to build a new fleet of submarines, ostensibly for Russia, but actually for her own use. This story is more plausible than that about secret construction in Germany itself, but the plan, if it really exists, is likely to prove difficult to carry out. German shipyard experts who have

reached Nikolaieff in pursuance of an agreement to modernize that establishment are said to have been unpleasantly surprised at their reception. They found the plant to have been almost destroyed by sabotage and neglect, the workmen idle, inefficient, and disobedient, and the local authorities unable or unwilling to support the German mission in its effort to restore things to an orderly state. Matters may eventually improve, but from the latest accounts it does not appear that the reorganization of Nikolaieff Dockyard has made much progress. Nor is it likely that the Germans will find conditions better at Kronstadt or Petrograd if they go there with the same purpose. Short of providing not only the material, but the whole of the labor themselves, their alleged plan of constructing a new navy in the Russian yards is likely to prove abortive, and German labor at present does not seem in the mood to lend itself to a new war plot.

Alarmist statements which have recently been published as to the strength of the Russian Navy are heavily discounted by the Admiralty Return of British and Foreign Fleets. According to this document only two of the Russian battleships in the Baltic are effective, viz., the *Marat* and *Paris Commune*, each of 23,000 tons, and an armament of twelve 12-in. guns. These ships are better known by their pre-Bolshevik appellation, *Petropavlovsk* and *Sevastopol*. Their sister vessels, *Gangut* and *Poltava*, are recorded as having "no military value at present." As for the four battle cruisers, *Navarin*, *Borodino*, *Izmail*, and *Kinburn*, displacing 32,500 tons and armed with twelve 14-in. guns, the first two were launched in 1917 and the second pair in 1915, but none has been completed up to the present, and building operations are at a standstill. It was reported from Paris a few weeks ago that the completion of these ships was being pressed forward with all speed. Of the four light cruisers laid down in 1913 for the Baltic fleet—6,800 tons, 29½ knots speed, fifteen 5.1-in. guns—the *Svietlang* and *Admiral Greig* were launched respectively in 1915 and 1916, while the *Butakov* and *Spiridov*, for which no launching date is given, may be still on the stocks, building having been stopped on all four vessels. As the older cruisers *Rurik*, *Bayan*, and *Admiral Makarov* have "no military value at present," the Baltic Fleet appears to have shrunk to the two Dreadnaughts named above, and, while the *Return* does not say so, it is quite possible that even these ships are no longer fully effective. The Baltic destroyer flotilla, which could muster on paper about 90 boats, has dwindled to eighteen effectives. Sixteen submarines are listed as effective, the majority being boats of 650 tons surface displacement. No further submarines appear to be under construction.

The Black Sea fleet has practically disappeared so far as serviceable units are concerned. It contains one old battleship, *Evstafi;* no cruisers, no destroyers, and three submarines, only one of which is a large boat. It will therefore be seen that to all intents and purposes the Russian Navy has gone out of business.—Hector C. Bywater in *The Naval and Military Record*, 16 August, 1922.

REPORT ON DISARMAMENT.—Lieutenant Colonel Stanley (to Commander Bellairs): "The latest report from the Inter-Allied Military Commission of Control shows that 33,484 guns and barrels of all kinds have been surrendered, and 33,410 have been destroyed up to date; in addition, 6,051 guns under construction were destroyed by the Germans prior to control; the records have been checked by the Commission; 87,377 machine guns have been surrendered and 87,351 have been destroyed up to date; 4,382,839 rifles and carbines have been surrendered and 4,369,330 have been destroyed up to date. The Commission consider that all important stocks or surplus war material in Germany have been surrendered for destruction, and that only a negligible number of guns, machine-guns and rifles may still be hidden by extremist parties. The Inter-Allied

Military Commission of Control have accomplished far more than the members of the Commission themselves considered possible at the outset of their work. The aeronautical disarmament of Germany was recognized as complete by the Allies on February 5, last. On that date, 14,731 aeroplanes had been surrendered and 14,260 destroyed. The Aeronautical Commission of Control has since been withdrawn.—*Army, Navy and Air Force Gazette*, 29 July, 1922.

A GERMAN LIST OF ZEPPELIN CASUALTIES—52 DOWN.—It was height against artillery, German Zeppelins against British guns and gun-carrying airplanes, and the Zeppelins got the worst of it. Nevertheless, the German airship-makers were prepared to try conclusions once more, at an altitude of 22,000 feet, when the war ended. Airplanes have since, of course, far surpassed this height, but a Zeppelin sailing over four miles high, especially aided by darkness and occasional clouds, could have met and beaten off any planes able to reach this altitude, so the Germans argued. Some statistics of the Zeppelins and other airships employed by the German Navy during the war, notes the London *Times*, have recently been published, for the first time, in the *Marine Rundschau*. It is officially recorded that the Allies destroyed 26 of the airships, and that 26 others were the victims of accident. Included in the report is a complete list of the ships, with the names of their commanders and watch officers, the date of their being put into Service, the number of cruises and attacks made, their air-port stations and a brief account of their ultimate fate. The *Times* summarizes and comments:

From first to last the German Navy had at its disposal 78 airships. Six were either air training-ships or were used for special purposes, so that 72 took part in actual scouting and operations. The figures show that the average for each vessel was 16 cruises and three attacks. The maximum number in commission at any one time was 19. The highest number in commission in a single year was 39 in 1917, but the greatest number of cruises and attacks was made in 1916. In that year the 31 airships in commission at various times made 296 cruises and 107 attacks. But it was also the year of the greatest losses. Eight were destroyed by enemy action, four by storm, and four by explosion. In the following year nine were lost by enemy action, and five by storm. The total loss for the whole period of the war was 52, made up as follows: Destroyed by enemy action 26; destroyed by storm, 14; destroyed by explosion, 12. Besides these, however, 17 others went out of service for various reasons.

Full particulars are given about the various stations. The double shed at Fuhlsbüttel was burned down on September 16, 1916. That at Tondern was burned out three times and rebuilt. Of the four double sheds at Ahlhorn, three were blown up and totally destroyed in the great explosion which took place on January 5, 1918.

Of the 52 airships lost, the crews of 19 were killed, the crews of six taken prisoners, and the crews of three were interned. In the case of the other 24 there was no loss of *personnel*. Nine airships were left in commission when the Armistice was declared, including the two school airships at Nordholz. One was in course of construction.

Of the six Zeppelins put into commission in 1914, *L-3* and *L-4* were stranded during the storm of February 17, 1915; *L-5* was stranded at Dünamünde, in Courland, on August 6, 1915, after being hit by enemy fire; *L-7* was shot down in flames by the enemy on May 4, 1916; *L-6*, the training-ship, exploded in its hangar on September 19, 1916; and *L-8* was shot down in action on March 5, 1915, and stranded at Tirlemont. Twelve were put into commission in 1915. *L-18*, commissioned on November 3, 1915, caught fire in the hangar at Tondern, a fortnight later, while being inflated. *L-9* blew up in the hangar at Fuhlsbüttel on Sep-

tember 19, 1916, and *L-10* was struck by lightning above Neuwerk Island on September 3, 1915. Of the rest, *L-12*, *L-15*, and *L-19* were shot down; *L-17* blew up in the explosion at Tondern; *L-20* was stranded at Stavanger, in Norway; *L-11*, *L-13*, and *L-16* were dismantled, and only *L-14*, the training-ship, survived to be handed over at the Armistice.

Of the 1916 ships, *L-21*, *L-22*, *L-23* (at sea), *L-31*, *L-32*, *L-33* (over London), *L-34* (over Sunderland), and *L-39* (over Compiègne), were shot down. *L-24* caught fire while entering the hangar at Tondern, and caused the explosion which destroyed *L-17*. *L-25* to *L-29* were Army ships. *L-30* and *L-37* went out of commission in 1917, and were handed over to the Allies at the end of the war. *L-36* and *L-38* were stranded.

The 1917 ships suffered bad losses both from explosions and in action. The great explosion at Ahlhorn on January 5, 1918, accounted for *L-46*, *L-47*, *L-51*, and *L-58* besides the Schütte-Lanz, *SL-20*; *L-57*, which had been intended for the expedition to German East Africa, exploded in mid-air on her trial trip on October 7, 1917, fourteen days after completion. The entire crew perished, and the cause of the disaster was never discovered. She was succeeded by *L-59*, which made the trip, but was recalled when over the Sudan because the Germans had then evacuated German East Africa. This vessel bombed Naples, and was engaged in an expedition to bomb Malta when she came down in flames in the Strait of Otranto for reasons unknown, as she was not then under attack.

The following were destroyed in action: *L-43* (in the North Sea), *L-44* (near Lunéville), *L-45* (over Sisteron), *L-48* (after bombing the Suffolk area, brought down by the *R. F. C.*, with Commodore Schütte on board), *L-49* (near Bourbonnes), *L-50* (in France, afterwards sailed away without crew), *L-53* (by British airman while scouting), *L-54* and *L-60* (by a British airman while in the hangar at Tondern), and *L-55* (over Tieffenort, in attack).

The Zeppelin war had been a continuous struggle on the part of the Germans to attain altitudes that could not be reached by the defense. In the summer of 1917 they had reached altitudes at which human beings could not live without oxygen (afterwards compressed air was used). The type *L-53* to *L-55*, then in use, had a cubic capacity of 56,000 cubic meters and a maximum altitude of 18,000 to 20,000 feet. But in 1918 they found their attacks badly hampered by British airplanes and the "excellently organized artillery" in England, and they were at best able to attack only in cloudy weather. After Captain Prölz was brought down with *L-53*, it was decided temporarily to abandon attacks till the new type, with a cubic capacity of 62,000 cubic meters and an altitude of 22,000 feet, was ready. Fortunately the German Navy mutinied and the German front collapsed before this was ready. *L-71* was handed over with the other eight to the Allies, and *L-72*, still unfinished, was ultimately completed and surrendered to France.—*The Literary Digest*, 19 August, 1922.

UNITED STATES

NAVY MEN AT COLUMBIA.—Thirty-three officers of the United States Navy are studying the problems of the modern warship and submarine in Columbia University's Summer session. One group of fourteen officers, among whom are captains Victor A. Kimberly and William R. White, are concentrating on the theory and application of the gyroscope. Another group of nineteen officers is pursuing specially arranged courses in preparation for regular training in the engineering schools of Columbia during the next academic year. The naval officers come to Columbia through an arrangement between the United States Naval Academy and the university.

The courses are the first of their kind arranged for Annapolis graduates, who never before have had summer instruction outside of the navy, and

represent an extension of the academy's general plan of co-operation with universities and technical schools. The practice of sending officers to Columbia, interrupted by the war, was resumed two years ago, and will be continued during 1922-23 by the nineteen officers who are now receiving preparatory training.

Contrary to custom, these officers, instead of doing postgraduate work at Annapolis, in various manufacturing plants or in the navy yards, are reinforcing their knowledge in the laboratories and classrooms at Morningside. The courses were devised by Dean George B. Pegram and his associate in response to a request made by Commander J. G. Fisher, head of the Postgraduate School at Annapolis. The naval authorities aim to provide more thorough training in advance of the winter and spring work of the officers at Columbia.

This group of nineteen is taking three intensive courses of two weeks each, Dean Pegram said recently. The first two weeks were devoted to work in physics of heat in special preparation for the later study of thermo-dynamics and mechanical engineering subjects. Professor W. L. Severinghaus of the Columbia department of physics, directed this work, which was followed by two weeks of study in alternating currents, involving theory and laboratory practice, under the guidance of Walter I. Slichter, professor of electrical engineering at Columbia.

During the closing two weeks of the Summer session, the officers are attacking the problems of electric storage batteries. This work is in charge of Professor Morton Arendt, who during the war was in control of construction of storage batteries for the navy submarine school in London, attaining the rank of commander.

The successful introduction of the electric drive on battleships and battle cruisers, it is said, makes this knowledge necessary to the officers responsible for ships of these types. Storage batteries are used in the underwater propulsion of submarines and the schooling which the officers are receiving this summer is necessary for subsea operation and for the safety of crews, accidents having resulted in the past from storage battery troubles.

The group of fourteen officers, mostly lieutenants, are supplementing their knowledge of the gyroscope under Professor A. G. Webster of Clark University, said to be one of the country's leading authorities in the field of dynamics. This course, it is said, is being given for officers of various grades, for the reason that it has become essential that a considerable number of the commissioned personnel of the navy be skilled in everything that relates to gyroscopics.

The navy uses the gyroscopic compass in the navigation of all its larger ships, and the problem of gyroscopic stabilization is highly important. Another field of importance, it was said, is the application of gyroscopic instruments to aircraft.—*New York Times*, 25 August, 1922.

A COMPARISON OF THE AUXILIARY FLEETS OF JAPAN, GREAT BRITAIN, AND THE UNITED STATES.—London, July 27.—Cable messages from Washington this week foreshadow developments in American naval policy which are believed here to be traceable to the activity now prevailing in Japanese dockyards. The General Board of the United States Navy, it is reported will recommend that Congress, in the session beginning in December, be requested to make appropriations for a considerable amount of new auxiliary tonnage, without which the ratio of strength *vis â vis* Britain and Japan cannot be maintained. As the ten scout cruisers of the *Omaha* class, 7,500 tons each, have been greatly delayed by inadequate funds, the American Navy today has not a single first-line cruiser in commission. The General Board is therefore said to be urging the rapid completion of these 10 ships, so that work can be started on a further group of cruisers designed on larger and more powerful lines. It is also

said to have recommended the addition to the submarine program of new boats for scouting and mine-laying duties.

Naval opinion on this side of the Atlantic considers the General Board to be fully justified in demanding more light cruisers in view of the American fleet's pronounced weakness in such vessels, but there is some misgiving as to the effect that the introduction of a new program would be likely to have on the international situation. That Japan has diverted to the construction of cruisers and submarines a large part of the money and labor she formerly expended on dreadnaughts is no longer a secret. There are so many of these auxiliary fighting craft now building or on order that both the Government and private shipyards have been able to keep most of their men on the pay roll, and there has been as yet no counterpart in Japan of the wholesale discharges of navy-yard personnel which have occurred both in Britain and the United States since the Washington Conference.

As time goes on the consequence of that fatal flaw in the limitation agreement, which left the signatories a free hand in respect of auxiliary construction, becomes more manifest. In so far as it aimed at ending naval competition in any shape or form the agreement has failed of its purpose. Rivalry in dreadnaughts has simply given place to rivalry in cruisers, submarines, etc., and while this form of competition may be less expensive, it may be quite as dangerous from the political point of view. At the risk of repeating information which has already been published in *The Sun* it is desirable to set forth once more the salient facts of the naval situation as it exists today seven months after the close of the conference.

(1) The limitation agreement specifies a ratio of 5-5-3 for the dreadnaught strength of the United States, British Empire and Japan, respectively. This ratio will actually prevail when the scrapping operations now in progress have been completed, since there is no question as to the loyalty with which all three powers are observing the letter of the agreement.

(2) The above-mentioned ratio was originally intended to embrace not only capital ships, but all types of men-of-war. This intention was defeated by the failure of the conference to agree on the allocation of submarine tonnage, and as every type of vessel below capital grade was ruled by the experts to be a potential anti-submarine craft, the possibility of unlimited underwater construction naturally led to the abandonment of restrictions on the building of all light-surface vessels.

(3) Japan has been the first power to take advantage of this liberty of action in respect of auxiliary fighting craft. With the possible exception of France, she is the only signatory which has laid the keels of new cruisers, destroyers and submarines since the limitation agreement was negotiated at Washington, and she is the only one now at work on a large program of these vessels. Taking all ships completed, building and authorized, the three-power ratio in light cruisers now stands approximately as follows: British Empire, 4.5; Japan, 3; United States, 1. This is based on the number of ships. If tonnage were taken as the basis the American position would be better; but numerical strength is what really matters, seeing that a ship can only be in one place at a time. Age is also an important factor in gauging efficiency, and on that showing Japan comes out still better, for of the 29 cruisers she will possess a few years hence, 24 were laid down subsequent to 1917, as against 6 British and 10 American.

(4) The Japanese submarine flotilla is very much stronger both in numbers and individual power than is generally known, and no other navy in the world is building so many large ocean-going boats. It is difficult to explain the exact position without bringing in a mass of figures, but I will try to make these as few as possible. At the present moment the

United States has the most submarines, *viz.*, 124, of which total 41 are still incomplete. This excludes 22 obsolete boats which have been scrapped during the present year. Fifty-six boats are of the long-range ocean-going type, that is to say they have a radius of 5,000 miles or more. The British Empire has 66 submarines, including six in Australia and two in Canada, but not counting 27 which are marked down for scrapping this year; and of this total about 40 are of long-range, ocean-going type. Japan has approximately 75 boats completed and building and at least 24 more authorized for commencement. This gives a minimum total of 99, but—and this is the really significant fact—not less than 80 of them are ocean-goers with a cruising endurance of 5,000 miles in the medium type and up to 12,000 miles in the larger type.

During the past three years no coastal submarines have been built in Japan, every boat laid down within that period having been designed for long-range cruising. Among those now completing and projected are many of 1,500 tons displacement and few of 2,000 tons. The newest boats are likely to be still larger. In their effort to hit upon a thoroughly efficient design the Japanese authorities have not only incorporated all the best points from the German boats handed over to them, but have sent experts to Europe to investigate the most up-to-date features of British, French and Italian submarine construction.

Japan's future fleet will thus comprise the following fighting units: Ten capital ships, 29 fast cruisers, more than 100 modern destroyers, 80 ocean-going submarines and an indefinite number of older torpedo craft and submarines which will still be effective for coast defense. In view of her magnificent strategic position, which makes her practically impregnable to direct attack, the number of auxiliary combatant craft she is building must be considered excessive for purely defensive needs. It would seem, therefore, that aggressive operations figure prominently in her war plans, the lavish provision of cruisers and long-range submarines pointing clearly enough to enemy merchant shipping as a target for special attack.

To say that Great Britain is becoming alarmed at the outlook might be an overstatement, but she certainly is dissatisfied with the way events are developing. As a state which depends for its existence on sea-borne supplies she is vitally concerned for the safety of her sea communications over any menace which invariably reacts on her naval policy. Her present relations with Japan are amicable enough, if not quite as cordial as they were, and there is no apparent reason why they should deteriorate to the point of bringing that power into the category of probable enemies. Nevertheless, if the Japanese shipbuilding program is carried out in its entirety, Great Britain cannot possibly rest content with her present establishment of cruisers and anti-submarine craft.

Even as it is, naval officers are anxious for more cruisers to be laid down, for, as they point out, very few of the ships we now have would be of any use whatever for operations in the Pacific. The majority of them were designed for North-Sea work and therefore do not possess the weatherliness or the fuel-endurance essential to ocean cruising. As a matter of fact, we have only six ships above 5,000 tons which are fast enough for modern war operations. The supply of destroyers would also be inadequate to cope with submarine raids on British shipping. Besides the hundreds scrapped since the armistice, a great many other boats have been laid up for economy, and as there is no money for repairs most of them are going to rack and ruin. It is doubtful whether we could now muster more than 150 effective destroyers.

Overburdened with taxation as they are, the British people are extremely reluctant to spend more money on armaments, particularly after being told that Washington had eliminated naval competition for many years to

come. They do not even relish the prospect of paying £16,000,000 for the two new battleships allotted to Great Britain under the agreement, and the Government's decision to proceed with these ships is encountering much opposition. Consequently, to be told now that a big program of auxiliary shipbuilding will probably have to be adopted in the near future is a bitter disappointment to them, and when it is realized that the action of Japan is mainly responsible for this there is likely to be a revulsion of popular sentiment against that country.

Auxiliary craft, it is true, are cheaper than battleships, but their cost has gone up enormously of late years. A modern ocean cruiser cannot be built for less than £1,500,000, which is only £500,000 less than the price of a pre-war dreadnaught, and the cost of other types has increased in proportion.

In the meantime the effect on American public opinion of the Navy General Board's demand for more ships to offset Japanese preponderance is awaited here with keen interest, not out of idle curiosity, but because it is felt that this demand may eventuate in a movement to have the whole question of minor naval armaments, with special reference to submarines, reconsidered at a second conference. This course was, I believe, recommended by the Italian delegates at the first gathering when it became clear that no settlement was to be reached in the submarine dispute.

It would, however, require great moral courage to convene a fresh conference for the avowed purpose of restricting, if not wholly abolishing submarine development, in view of the strong opinions which both France and Japan are known to entertain on this matter. The Government taking such a step would unquestionably expose itself to a rebuff, but the issue at stake is momentous enough to justify the risk. The world is already threatened with a recrudescence of that naval rivalry which is, by common consent, the most fruitful cause of war. Great Britain's hands are tied, because her notorious vulnerability to submarine attack lays her open to the charge of pursuing her own selfish interests if she seeks to do away with that particular mode of sea warfare. If, therefore, a lead is to be given at all, it must be given by the United States. Only a new conference can complete the work that was so well done up to a certain point and then left half-finished by the initial gathering at Washington.—Hector C. Bywater in *The Baltimore Sun*, 10 August, 1922.

MERCHANT MARINE

SHIPPING BOARD'S MONETARY LOSS EXPLAINED.—Why can our mercantile fleet not be operated profitably under Government ownership? The first impulse is to reply that under present arrangements no reason exists why it should not be. At the head of the traffic and operating divisions of the Shipping Board are practical shipping men of wide experience who have successfully helped to direct the activities and promote the business of private shipping concerns. The assumption that they should be able to duplicate these efforts on behalf of the Government with equally gratifying results is a reasonable one. It is conceded that the red tape of officialdom hampers them, but this should affect merely details and not policies.

Furthermore, the four hundred Government ships in service are being operated by managing agents who have been thoroughly tried in regard to ability and integrity. By the process of elimination these vessels are now entrusted to the most expert shipping men in the country, and are in commission on a basis removed only by a step from that of private ownership. It is also true that much of the Government's tonnage is inefficient, but the ships actually in service are the cream of the fleet and comparable with any other vessel afloat. Similar ships which have been sold by the Board to private owners are being operated successfully, thereby

disproving the inefficient tonnage argument. Neither can the incompetency of crews and higher wages be advanced as sound reasons, inasmuch as the Shipping Board has the same opportunity as a private owner to secure competent crews at the same wages. Despite these facts the unqualified assertion is frequently made, and left unquestioned, that Government ownership of vessels is an insurmountable handicap to profitable operation. The conclusion therefore is that some cause underlying the conditions of physical operation and preventing the application of strict business methods is responsible. This reason is to be found in the fact that Government tonnage belongs to the citizens of the United States and that the wishes of different communities in regard to it must be considered and catered to.

Here then is the fundamental difference between Government and private ownership, a situation which is often lost sight of when the activities of the Shipping Board are considered. In planning the services of its ships a private concern has regard only for the trade possibilities of its routes. It serves only those ports where cargo is offering in paying quantities. The Shipping Board, on the other hand, has to take into account the additional factor of rendering service where it is demanded, whether or no that service is financially profitable.

Hence we find a condition in which Government vessels are compelled to call at various ports not because adequate cargoes can be obtained there, but because the communities demanding the service claim that they have a proprietary interest in the ships. The Shipping Board cannot turn a deaf ear to these demands and is compelled to heed the requests. The Board must not only listen to the dictates of business practice but also to the voice of the American people. Thus a situation exists in which Government vessels are calling at ports which would be ignored by private companies. The service rendered raises the prestige of the port and its community, but the cargoes secured are in many instances insufficient to cover the cost of making the calls. Therefore in the final analysis the Government is losing money not so much because of inferior methods of operation but in giving service which a private company is not called upon to provide.

This is a circumstance over which the Board has no control. Since it has to face this ever-constant demand for service, much of which is not financially advantageous, the Government is at a disadvantage when its position is considered in relation to that of a private concern. It must employ business methods not only as good as but better than those of its private competitor, if this handicap is to be overcome. But since private companies have been compelled to run their business on a basis of the most rigid economy and effectiveness the difficult task confronting the Government in endeavoring to improve on these measures is at once apparent.

This naturally leads to the question as to what the Shipping Board is doing in trying to inject recognized business methods into its activities. It is admitted that the present régime is making a far better showing than that of its predecessors, and the operating losses have been greatly reduced without impairing the services. This has been accomplished by the simple expedient of creating a confidence on the part of the American shipper in Government vessels. A year ago shippers studiously avoided utilizing Government vessels because of the unreliability of their movements. Sailing schedules were arranged but rarely adhered to. If a ship did not have a full cargo on the date of her advertised sailing, she would be held until such time as her holds were filled regardless of the delay to the cargo placed in the ship prior to her scheduled sailing date. Thus a shipper could never be sure of the day on which his goods would leave port, and delays of a week, a month or even longer, were frequent.

Nothing could destroy the confidence of shippers in Government tonnage more effectively than these delays and the state was reached where solicitors of business for Government ships found it impossible to produce results.

This condition has been completely changed, and Shipping Board vessels now sail on their advertised date irrespective of whether they have full cargoes or not. When this policy was first adopted the ships often sailed with as little as half their cargoes, and in consequence the operating losses were very heavy. By adhering rigorously to this system the confidence of shippers in Government vessels has been largely restored, for they now have reasonable assurance that the ships will sail on scheduled time, and it is correspondingly easier to secure freight for them. Ships that a year ago were leaving port with half cargoes are now sailing fully loaded, or nearly so and, if this policy is adhered to, it will not be long before American shippers will have absolute confidence in Government ships.

The rationing system adopted by the Board in recent weeks is also in line with the most approved business methods. According to Joseph E. Sheedy, vice-president of the Emergency Fleet Corporation, the division of operations of the Shipping Board is attempting to carry on its work "on as near a commercial basis as possible." The rationing system is divided into four main branches as follows: fixed allowance for subsistence, fixed allowance for repairs, fixed allowance for stores and fixed allowance for fuel. By this means it is expected that the Board will be enabled to make a considerable reduction in its operating appropriations in addition to increasing the efficiency of operation of its ships by the managing agents.

The Board is actually losing approximately $3,000,000 per month in cash as a result of its operations, but viewed in its broader aspect this amount is in reality being spent for the creation of goodwill. The loss is incurred not through inferior operation, but in the rendering of service as a result of which new trade will be developed and business built up. Although ships are incurring losses through having to call at certain ports, a goodwill is being created in these communities which will bring better business conditions in the future. Therefore although the Shipping Board is facing an unavoidable situation in having to serve these ports it is doing good work in laying the foundation for future trade. The day will come when the losses now being incurred will be more than repaid by the larger volume of business which will be transacted as a result of the service which Government tonnage is now giving, and ships that are now serving these ports at a loss will be able to do so at a profit. In this regard the Board is in the position of any other large business concern. A corporation entering a new industry expects to lose a large amount of money each year in the development of business and the creation of goodwill. Viewed in this light the losses of the Board are not exorbitant since they amount annually to about 1½ per cent of an invested capital of three billions of dollars.

It is not an exaggeration to state that if the Board were free to send its ships where it pleased regardless of the demand for services its financial showing would be as creditable as that of any private concern. But it must be remembered that its object is to build up a merchant marine for the future and in this work it is fulfilling its mission. If its present policy is carried through to its logical conclusion, a goodwill will be created for American ships that will serve as an inducement for private capital to invest in Government tonnage. A shipowner will more readily buy ships if they can be placed in a trade in which they are regarded with confidence and where sound business connections are already established. Therefore the Shipping Board is really paving the way for the disposition of its ships to private owners on a basis which will ensure the profitable operation of the vessels.

The logical outcome of this policy is for the Board to devise a scheme whereby private shipping interests can purchase Government tonnage on easy terms and so carry on the work which the Board has commenced. Losses are being incurred in the building up of an American merchant marine, but if, as is contended, the possession of a successful mercantile fleet is a matter of national importance, then it is only fair that the nation should bear the cost of pioneering.—*The Nautical Gazette*, 5 August, 1922.

ADVOCATES SHIP SUBSIDY. Williamstown, Mass., Aug. 22 (Special). —The problem of American shipbuilding was discussed today at the Institute of Politics, where R. T. Merrill, of the Bureau of Research of the United States Shipping Board, was invited to address a round table under the chairmanship of W. S. Culbertson. Mr. Merrill said that America could not hope to compete with the shipping of other countries for years to come on account of the high cost of American labor. A successful merchant marine, he said, depends on three factors—plentiful and cheap coal, iron ore and labor. America has reached a point where material used in building ships is available and cheap, but this is not true of American labor, he added. American labor is fifty cents higher than foreign labor, and about fifty per cent of the shipping costs go into labor, he argued.

The British visitor, Philip Kerr, said the cost of labor was largely a matter of the cost of living, and intimated that this was, in his opinion, bound up with such questions as protective tariffs. Mr. Kerr said the prosperity of one nation was bound up with the prosperity of all and that he did not feel any jealously because America wanted to build up her merchant marine. He assumed that the more business America did the better it would be for the industries of other countries.

Describes Merchant Warfare

In the opinion, however, of navy men at the conference the whole process of foreign trade is a kind of war which is carried on in peace time by means of merchant fleets and in war by means of these fleets plus battleships. Admiral Rodgers, chairman of the executive committee of the General Naval Board, said that before the days of international co-operation desired by Mr. Kerr, when the lion and the lamb would lie down together, the lamb would also have to learn a few lessons in throat-cutting.

Admiral Knapp emphasized the absolute necessity, in his mind, for a merchant marine. The fact should be kept in mind that the further off naval or military operations are likely to be in time of war the larger is the merchant marine needed, he pointed out. It takes, for instance, about twelve tons of shipping per year to keep a man in France, he said, and it is, roughly speaking, true to say that if the scene of possible operations were twice a given distance, twice as large a merchant fleet would be needed to keep up the shipment of supplies in time of war. The necessity of proper communications system also was stressed by Admiral Knapp as being not only essential to commerce, but to the fleets in time of war. He said he hoped to see a great increase in American foreign commerce, as this would not only justify a large American merchant marine, but an adequate navy.

Advocates Ship Subsidy

Mr. Merrill abandoned all hope of America being able to compete in the tramp steamer traffic. He said this class of business was such that cargoes could only be carried at very low rates and nothing in the way of improved service was obtainable by hiring skilled men instead of the low-

priced variety now employed. America might, however, do more in freight traffic on liners, where higher freight rates were paid for more efficient service, he said. Nevertheless, there are still difficulties because of American high cost of operation and he hoped that the Ship Subsidy bill would be passed.

"Since the merchant marine," he concluded, " is essential to the economy of the country and since the ships and the shipyards are necessities from the standpoint of naval defense, there remains only the alternative of meeting from the national Treasury, since it is for national needs, the additional cost of ships built in American shipyards in order that our vessels, placed upon a parity as far as construction costs go, may compete with a reasonable prospect of success against the products of the cheaper labor in foreign countries."—*Baltimore Sun*, 23 August, 1922.

WORLD'S MERCHANT TONNAGE AT CLOSE OF FISCAL YEAR.—The following table, taken from Lloyd's *Register* for 1922-23, shows the number and gross tonnage of the vessels of 100 tons and upward belonging to each of the principal maritime nations of the world in June last:

Country			No. Ships	Gross Tons
Argentine			216	181,555
Belgium			275	579,477
Brazil			399	492,571
British Empire:				
United Kingdom	8,849	19,295,637		
Australia and New Zealand	636	766,038		
Canada—Coast	877	1,020,984		
Canada—Lakes	72	170,070		
Hong Kong	94	231,869		
India and Ceylon	214	235,100		
Other Dominions	579	322,822		
Total			11,321	22,042,520
Chile			126	131,401
China			134	188,388
Cuba			65	62,677
Dansig			42	107,231
Denmark			822	1,038,138
Esthonia			98	45,259
Finland			352	213,671
Fiume			64	81,362
France			2,094	3,845,792
Germany			1,723	1,887,408
Greece			379	668,127
Holland			1,164	2,632,713
Italy			1,413	2,866,335
Japan			2,026	3,586,918
Jugo-Slavia			65	81,204
Latvia			67	40,124
Norway			1,852	2,600,861
Peru			74	101,209
Portugal			286	285,878
Roumania			31	72,297
Spain			973	1,282,757
Sweden			1,345	1,115,375
United States:				
Sea	4,886	14,738,506		
Great Lakes	495	2,247,690		
Philippine Islands	99	76,264		
Total			5,480	17,062,460
Uruguay			53	76,311
Other countries			799	691,635
Country not stated			197	309,132
Total			33,935	64,370,786

Below are shown the changes in the tonnage of the countries enumerated above as compared with a year ago:

Country	Tons Gross 1921	Tons Gross 1922	Difference
Argentine	167,154	181,555	+14,401
Belgium	551,031	579,477	+28,446
Brasil	499,325	492,571	−6,571
British Dominions	2,499,244	2,746,883	+247,639
Chile	113,447	131,401	+17,954
China	163,037	188,388	+25,351
Cuba	58,553	62,677	+4,124
Denmark	964,464	1,038,138	+73,674
Esthonia	41,183	45,259	+4,076
Finland	198,352	213,671	+15,319
France	3,652,249	3,845,792	+193,543
Germany	717,450	1,887,408	+1,159,958
Greece	599,929	668,127	+68,198
Holland	2,225,787	2,632,713	+406,926
Italy	2,650,573	2,866,335	+215,762
Japan	3,354,806	3,586,918	+232,112
Latvia	53,342	40,124	−13,218
Norway	2,594,058	2,600,861	+16,803
Peru	87,167	101,209	+14,042
Portugal	296,847	285,878	−10,969
Roumania	73,973	72,297	−1,676
Spain	1,165,541	1,282,757	+117,216
Sweden	1,160,211	1,115,375	−44,836
United Kingdom	19,571,554	19,295,637	−275,917
United States	17,026,002	17,062,460	+36,458
Uruguay	85,886	76,311	−9,575
World Total	61,974,653	64,370,786	+2,396 133

SIXTH OF WORLD'S MERCHANT TONNAGE IDLE.—According to latest advices, over 10,000,000 gross tons of shipping or approximately one-sixth of the world's merchant fleet is now idle. Of this unemployed tonnage about 4,625,000 tons is laid up in American ports and flies the United States flag.

Although the American merchant marine has been harder hit than any other, British shipping has also been severely affected, and whereas the American figures are stationary, or show a slight improvement, British records show a continued falling off.

Idle ships in British ports number 600. In this country the Shipping Board has tied up about 1000 steel vessels in addition to the 300 wooden ships.

There were approximately 1,700,000 gross tons of vessels flying the Union Jack laid up in the principal ports of the United Kingdom on July 1, as compared with 1,300,000 on April 1. Taking into consideration the smaller ports and shipping laid up in foreign harbors, it is estimated that 1,900,000 tons of British shipping is eating its head off in idleness, or ten per cent of the total merchant marine of the Kingdom.

Although the tonnage laid up is not generally the most efficient, the average value of the idle vessels is estimated at not less than $45 a gross ton. Thus the total capital involved the world over is in excess of $450,000,000. The cost of the Shipping Board vessels now idle is placed at $1,000,000,000 alone.—*Nautical Gazette*, 19 August, 1922.

CLYDE SHIPBUILDING NEARLY CUT IN HALF.—Within a year the amount of tonnage under construction on the Clyde has decreased by almost one-half. At the end of June of last year Clyde shipbuilders had on hand 238 vessels of a total measurement of 1,346,328 tons, while at the end of last month the total amount of work under construction had shrunk to 106 vessels of 680,346 tons.

The falling-off is not confined to any particular type or size of vessel, but is general all around. At this time last year there were 27 motorships

being built on the river, but now there are only 12, the total tonnage of which is 82,132 tons.—*Nautical Gazette*, 5 August, 1922.

BOARD'S ACTIVE AND IDLE SHIPS.—The Shipping Board issued a statement last week showing what disposal was being made of the Government's 1,648 ships on July 31. The first table shows the number of steamers covering the various trade routes:

Route	Ships	Deadweight tons
United States Government	4	38,636
Northern Europe	166	1,424,651
Southern Europe	34	268,117
Orient and Australia	70	718,257
Africa	9	76,840
South America	39	317,042
West Indies	11	45,937
Foreign service	19	111,966
Coastwise	9	56,941
Totals	361	3,058,387
Steel vessels tied up	913	5,875,388
Wooden vessels tied up	236	869,441
Vessels chartered to independent companies	30	137,565
Tankers	90	805,676
Under custody of United States Shipping Board as mortgagee	3	23,283
Awaiting orders or reconditioning	2	27,004
Awaiting assignment	10	74,663
Under custody of United States Shipping Board pending disposition		10,550
Awaiting delivery to purchaser	1	5,610
Contract steel cargo vessel unfinished	1	9,400
Grand totals	1,648	10,897,007

RELATIVE RANK OF LEADING MARITIME COUNTRIES.—The following table shows the comparative positions of the twelve leading maritime countries in 1914 and in 1922:

	1914	1922
1.	Great Britain	Great Britain
2.	Germany	U. S. A.
3.	U. S. A.	Japan
4.	Norway	France
5.	France	Holland
6.	Japan	Italy
7.	Holland	Norway
8.	Italy	Germany
9.	Austria-Hungary	Spain
10.	Sweden	Sweden
11.	Spain	Denmark
12.	Greece	Greece

MOTORSHIPS BUILDING IN JUNE.—Of the 866 vessels of 3,235,430 gross tons reported by Lloyd's *Register of Shipping* to be building in the world's shipyards, except those in Germany and Danzig, at the end of June, 103 of 251,328 tons were motorships. More than half of this motorship tonnage was under construction in Great Britain. Details are shown in the following table:

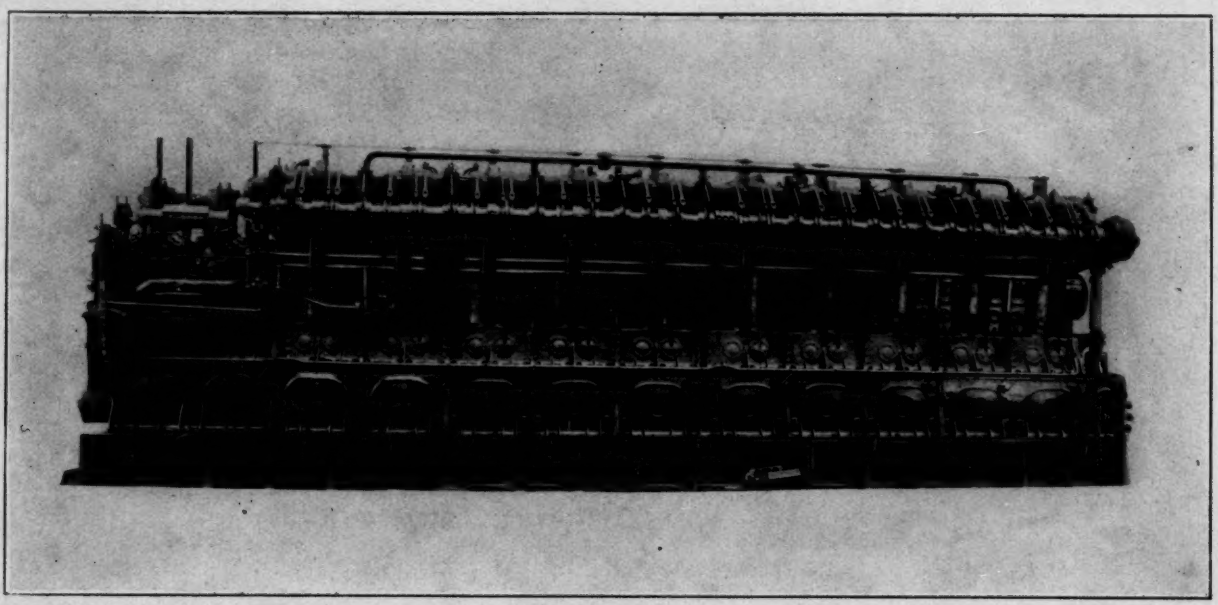
Country	No.	Gross Tonnage
British Dominions	1	253
Brasil	1	2,170
Denmark	6	22,855
Esthonia	8	2,791
Fiume	2	340
France	1	8,500
Greece	1	600
Holland	12	10,800
Italy	18	23,048
Norway	3	7,720
Portugal	3	1,700
Sweden	12	32,119
United Kingdom	32	129,134
United States	3	9,298
Total	103	251,328

ENGINEERING

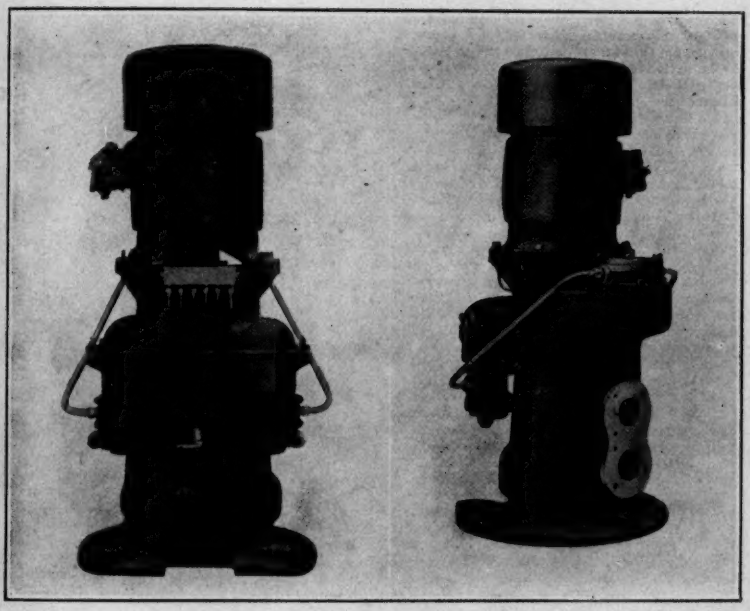
NEW 3,000 H.P. DIESEL ENGINE FOR SUBMARINES.—M.A.N. 4-cycle, 10-cylinder engine, 20.866″ bore X 20.866″ stroke: Rated Brake Horsepower 3000 at 380 R.P.M. Length overall—37′7″; width overall—5′7″; height overall—11′4″; height over crankshaft—9′0″; weight of engine-only (dry) 160,000 lbs; about 80 tons or 55 lbs. per rated horsepower; two-cylinder air compressor of 1265 ft. per minute, free air capacity (16.1 per cent of working cylinder volume); 4 stages—2500 ft. per square inch discharge pressure; circulating water piston cooling oil and lubricating oil furnished by motor driven pumps. Air starting and direct reversible.

ELECTRIC DRIVE FERRY BOATS.—New York City shows confidence in the reliability of the electric drive as plans and specifications have been completed for three large ferry boats to operate between New York City and Staten Island. Each vessel is to have 2,200 shaft horsepower. The power plant consists of four water tube boilers with working pressure of 250 pounds, one main turbo generator designed for 2,300—3,000 volts at 3,000 revolutions, and two propulsion motors of the three-phase alternating current induction type. As these motors drive screws, which are stern or bow propellers depending on the direction in which the vessel moves, an unusual problem is introduced which is solved by providing two stator windings for each motor. When operating as a stern propeller the appropriate stator winding permits the motor to deliver 2,100 shaft horsepower, whereas while operating as a bow propeller the other stator winding permits the motor to deliver only about 100 shaft horsepower.—*Bureau of Engineering Bulletin.*

A NEW TYPE OF CENTRIFUGAL PUMP.—With the introduction of electrically driven centrifugal pumps for marine service, there has been a tendency of late to adopt the vertical spindle design in preference to the horizontal type over which it possesses certain advantages. In addition to its being lighter and occupying less floor space, the upright pump is more easily accessible, its alignment is more certain and is less likely to be disturbed by connecting pipes or the movement of the ship. Furthermore the position of the motor is such that it is easily protected from water, and its commutator is readily examined. While the centrifugal pump, however, is quite practicable for direct sea pumping for salt water circulating systems, salt water piston cooling, and sanitary work, there are many pumping duties aboard ship for which the ordinary type of centrifugal pump is not so satisfactory on account of the unavoidable presence of air in the suction system. This means that the pump and the suction pipe must be primed before water can be raised. In bilge and ballast pumping on board ship, there is usually air present in the



NEW 3,000 H. P. DIESEL ENGINE FOR SUBMARINES
(For description, see page 1806)



FRONT AND BACK VIEWS OF THE DRYSDALE CENTREX PUMP

suction pipe, owing to small leakages in pipe joints, the occasional uncovering of the strum boxes when the ship rolls, and the fact that the ship construction does not always allow of the free flow of water to the suction pipe, especially when the tanks are nearly empty.

In order to overcome this difficulty, Drysdale and Co., Limited, of Yoker, Glasgow, have recently introduced a new design of pump, known as the centrix, in which the air is first separated from the water, after which both air and water are dealt with separately by properly designed pumps. The action of the Centrex pump is thus analogous to the newer systems which are used in connection with the marine surface condenser.

The illustrations we give above will serve to show some of the chief features of this pump. The main casing which, unless otherwise specified, is in cast iron with renewable wearing parts, is extended to form an air-separating chamber and the motor seating. It is provided with a hand hole, giving access to the impeller eye, and it is in two parts so as to enable the impeller and spindle to be removed without breaking any pipe joints. The hydraulic design of the pump is such that by using a single-sided type of impeller the thrust is in the upward direction, and the whole unit is practically free from bearing pressures when the pump is running. The air pumps are two in number, and are constructed of gun-metal. They are driven from the pump spindle through a cross shaft by means of worm gearing. The suction valves are of the piston valve type, while the discharge valves are of the metallic disc type, and are readily accessible. It will be noted that the suction and discharge branches are situated at the back of the pump directly over one another, thereby doing away with the necessity of banding the pump. The bearings are arranged for easy examination, and the thrust and end journal bearings are of the ball type, the former having two ball races, so that it can take the thrust in either direction. The electric motor is drip-proof and its design incorporates the best features of the vertical spindle protected type. The pump we have described has, so the makers inform us, been applied to motor ship service with success.—*The Engineer*, 4 August, 1922.

A NEW REDUCTION GEAR.—A new invention which marks an important development in gear construction, and which can be applied with advantage in all cases where it is required to increase or reduce gear, is the "H.R." reduction gear which is being developed by the "H.R." Gear Co., Ltd., 168, Regent Street, W. 1. The chief point of interest, perhaps, is found in the absence of the usual spur wheels and the introduction of worms and wormwheels.

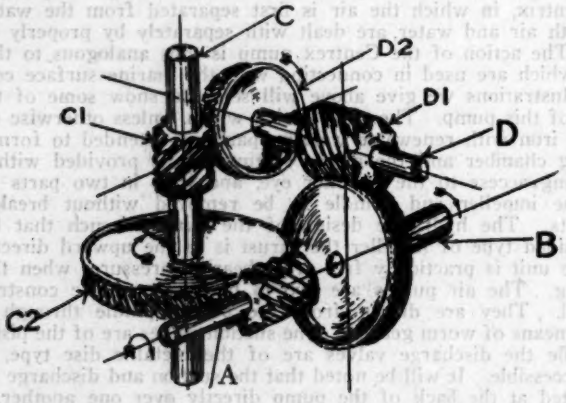
It can, moreover, be used as an alternative to ordinary spur reduction gearing whenever the latter is applied. Ratios of 100,000 to 1 can be obtained in the simple form of gear, and in the compound gear 10,000,000 to 1, although the gear is very small and compact in spite of the enormous reductions given.

The H.R. principle lends itself to a remarkably neat and simple form of variable ratio gearing in which, with the addition of one element, a three-speed gear is obtained and with two additional elements five speeds are possible. These variable ratios can permit, if desired, the rotation of the driven-shaft in the same direction as the driving shaft at all speeds, or any desired number of ratios may be used for reverse motion.

In addition, a special form of gear-cage provides an extra reversing gear. In all forms of multi-ratio and reverse gearing the efficiency of the H.R. gear remains approximately constant. The same methods being employed for all ratios as for the single reduction no intermediate trains or extra gears are in operation.

This last feature is likely to have great influence on automobile design, particularly when a direct drive is employed on top speed as no

noisy lay-shaft or constant mesh pinions are engaged. In this connection absolute silence at all speeds is an important feature. By a suitable arrangement in mounting the various elements eight or twelve changes of speed can be obtained, and by mounting the shafts at other than right angles around the main shafts almost any number of speeds can be obtained.



WORKING PRINCIPLE OF H.R. REDUCTION GEAR

The H.R. principle, being entirely new, opens many avenues of gear application which have hitherto been considered impracticable. In many respects its application makes possible that which before was impossible, as, for instance, the starting and lighting of motor vehicles by a single unit machine; special hoist and crane arrangements; direct mechanical stokers; scrapers for boiler economizers, etc.

With the present form of gearing used in conjunction with steam turbines, electric motors, petrol motors, etc., driving slow-moving parts, such as ships propellors, fans, heavy machinery, a compromise in efficiency has to be accepted and relatively heavy power units must be used. In other words, owing to the practical limit of ordinary gear reductions as regards space, weight, efficiency, etc., either the driving or driven member has to turn at a greater or less speed than that at which it would give its highest efficiency. With the H.R. gear there is practically no limit to the gear ratios which can be used.

One important feature where necessary is the addition of a cushion reaction and safety device. This enables gear reduction to be used satisfactorily where intermittent overloading has hitherto been a continuous source of trouble, as for instance, in the case of crushing, grinding, and rolling machinery.

This gear revolutionizes the electrical equipment of the automobile, being absolutely silent, almost impervious to wear, running as it does under ideal conditions, whilst eliminating a considerable number of parts and reducing equipment costs.

As the axis gear shafts are placed at right-angles to the axis of the driving and driven shafts four to eight additional drives can be obtained from the extremities of the gear shafts.

The working principle of the H.R. Reduction Gear is as shown in Fig. 1. Two shafts (C and D) are mounted transversely to the driving and driven shafts (A and B) and are connected by a worm (C_1) on the shaft (C) and a worm wheel (D_2) on the shaft (D). A worm wheel

(C2) on the shaft (C) is in gear with a worm on the driving shaft (A) and a worm (D1) on the shaft (D) is in gear with a worm wheel on the driven shaft (B) so that the essence of the invention is the placing of gear shafts around the periphery of the driving worm and the driven worm wheel, thus giving concentricity.—*Engineering and Industrial Management*, 10 August, 1922.

THE MODERN OIL ENGINE.—In discussing the heavy-oil engine, engineers are too much inclined to revert back to its early history in judging its present comparative worth. It is true that at one time breakages of crankshaft, cylinders and cylinder heads were frequent, but this is by no means different from the results obtained with other prime movers when first built.

Realizing that engineers should appreciate the wonderful strides made by the oil engine in recent years, Dr. Lucke describes in this issue some of the difficulties met with and the steps taken to overcome them. As he points out, the greater number of parts of an oil engine closely correspond to like parts of the steam engine, and these in themselves have given little trouble. It is the process of combustion within the cylinder that caused most of the high maintenance of former days. The method of introducing the fuel into the cylinder is better understood now, and as a consequence broken parts are seldom encountered.

Dr. Lucke states that there is but little difference in the results obtained from two- and four-stroke-cycle engines. One has more moving parts, but to offset this disadvantage has a better fuel consumption. Many may disagree with his contention that the small units should be two-stroke-cycle while the large engines should be four-stroke-cycle, for apparently both types are used successfully in the same capacity range.

Of especial interest is the discussion on the solid-injection engine. If it is possible to build an engine without an air-compressor that will show as good results as the air-injection Diesel, it would seem that by a lower manufacturing cost the former would speedily overcome the Diesel's superior position.

Apparently, the solid-injection principle will be used only on engines of small powers when the advantages of the air-injection Diesel cannot offset the decrease in interest charges resulting from the use of the cheaper unit. Undoubtedly, in time each type will find its own field, when it can be used to the greatest advantage, in the same way that the semi-Diesel at the present time has a range of capacities where it proves more economical that the Diesel.—*Power*, 15 August, 1922.

MARINE DIESEL ENGINES. *Difference in Design.*—At the last meeting of the Diesel Engine Users' Association, Mr. H. F. P. Purday, B. Sc., A. C. G. I., A.M.I. Mech.E., read a paper on "Marine Diesel Engines." In referring to the main points of difference in the design of marine Diesel engines as compared with land engines, he pointed out the fact that the hull of the ship being subject to more or less violent motion did not form the rigid foundation which was provided in the case of the land engine. It was, therefore, necessary to provide for considerable rigidity in the engine frame or in the seating in order to avert troubles due to the main bearings getting out of alignment. Crankshafts considerably stronger than those used in land practice must also be provided. To provide for ability to start up from any crank position it was also necessary to use engines having a certain minimum number of cylinders, namely, at least six for the four-stroke engines, and four for the two-stroke engines.

The marine Diesel engine had the advantage of unlimited cooling water being available, and with the temperature kept within reasonable

limits there was practically no deposit. This was a great advantage in reducing the risk of piston seizure, cracked covers and cracked pistons, etc. All marine Diesel engines were also fitted with crossheads and guides, which practically eliminated the trouble of piston seizure.

After referring to the principal types of marine Diesel engines, the author dealt with the subject of the four-stroke and two-stroke engine, and referred to opposed piston two-stroke engines using solid injection and air injection of fuel. The "Still" engine was mentioned as being in a class by itself. There was considerable controversy on the subject of heat stresses, and there could be no question but that the provision of relatively small two-stroke cylinders to perform the same work as relatively large four-stroke cylinders did entail some thermal problems of an important character.

In dealing with fuel injection systems, the author stated that so far the best fuel consumption with the solid injection system seemed to be associated with high maximum pressures, which were penalized by the registration societies. When the maximum pressure was limited to 500 lbs. per square inch the fuel consumption was usually slightly higher than with the air-blast system.

The permissible mean pressure for two-stroke engines depended largely on the efficiency of the scavenge process.

The piston speeds of two-stroke engines were generally between about 500 and 700 feet per minute. Comparatively low piston speeds had been adopted on account of the desirability of making use of low scavenge pressure in order to secure a good mechanical efficiency, and to keep the revolutions low on account of the propeller efficiency. Two-stroke engines, however, were not necessarily restricted to low piston speeds.

The author discussed the thermal difficulties of large Diesel engines, and pointed out that the trend of modern design seemed to be to eliminate extensive temperate stresses by dividing the castings into smaller pieces having considerable freedom from expansion. He favored the practice of providing concave crowns to pistons, as the further the center of the crown was away from the fuel valve the less heat it would presumably receive.

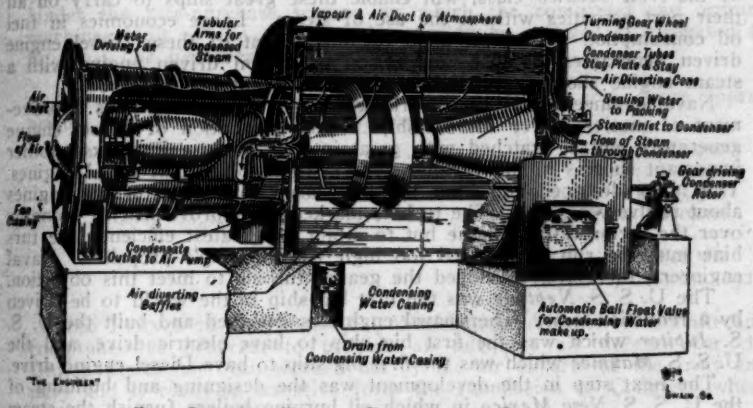
The author took the view that the Diesel engine must be seriously considered in the near future for propelling large engines requiring something like 16,000 s.h.p. per shaft.

In the discussion that followed, the view was expressed that further development of the marine Diesel engine was likely to follow along the lines of the double acting two-stroke engine. Further interesting information was given concerning the cylinder construction of the "Still" engine.

Reference was made to the greater use of the larger sizes of engine for land use on the continent and in other countries abroad. This was possibly due to some extent to the fact that this country was a coal-producing country. Stress was laid on the importance of reducing as far as possible the cost of manufacture, and a point was made that the present high cost of the larger units for land use was due to the comparatively small demand up to date.—*Engineering and Industrial Management*, 27 July, 1922.

A ROTARY EVAPORATIVE CONDENSER.—The steam condenser shown in the accompanying drawing, which is made to the designs of Mr. D. M. Ramsay by Fullerton, Hodgart and Barclay, Limited, of Paisley, is of topical interest, as it is of the same type as that installed on the new condensing turbine electric locomotive described in our issue of March 24, last. The condenser is, however, not necessarily confined in its application to locomotive work alone; it is being put forward for general

service where cooling water is scarce, and it is nevertheless desirable to have a high vacuum. It is, in fact, claimed that this condenser requires only 1 lb. of water for every 1 lb. of steam condensed, and that it will, at the same time, maintain a vacuum of 29 in.



THE RAMSAY ROTARY EVAPORATIVE CONDENSER

On reference to the drawing, it will be seen that the active part of the condenser comprises a cage of small tubes expanded into two headers and mounted on hollow trunnions. One of the trunnions provides a means of ingress for the steam to be condensed, while the other forms an outlet for the condensate and the incondensable gases. The header at the inlet end is divided up by a number of radial partitions, and there is a baffle at this end, which blanks off the lower sector-shaped partitions. In this way the steam is guided into the upper nests of tubes and kept away from the lower part.

The whole cage is slowly rotated by mechanical gear in a tank which is filled with water to such a depth that all the tubes are, in turn, immersed. As the tubes rise out of the tank they are covered with a thin film of water, and it is the evaporation of this film, under the influence of a strong draught produced by a fan, that absorbs the heat given off by the steam in the process of condensation. This draught of air enters the cage of tubes at the opposite end to the steam, and after being distributed by a number of baffles escapes at the top of the casing.

It is, of course, necessary that the two trunnions should be kept airtight, and to this end they are equipped, not only with stuffing-boxes, but also with a water service for sealing purposes.—*The Engineer*, 28 July, 1922.

DIESEL ENGINES AS AUXILIARIES ON BATTLESHIPS.—The installation of Diesel engine driven electric generators in the U. S. S. *Maryland*, *Colorado*, and *West Virginia* marks another step in the development of motive power for capital ships. The U. S. S. *Colorado* and *West Virginia*, which are now nearing completion, have two 400-kilowatt, 240 volt generators, each driven at 350 revolutions per minute by a 950 horsepower Busch-Sulzer Diesel engine. Two balancing sets will be provided to enable the generators to be used on the ship's 120 volt lighting circuit. A similar installation will be placed in the U. S. S. *Maryland* upon her return from Brazil, and it is also planned to equip the new airplane carriers *Lexington* and *Saratoga* with two of the same type of generators.

After this installation is completed these ships will be able to dispense with fires under their boilers when lying in port in moderate weather, as the extension of electric pump equipment in addition to other electrical appliances which have been placed in ships since the completion of the *New Mexico* class, will enable these great ships to carry on all their port activities without the use of steam. Large economies in fuel oil consumption will result upon the installment of these Diesel engine driven generators, because comparison of an oil driven engine with a steam engine shows a relative economy of about one to three.

Naval engineers have been working for years to develop this improvement of motive power for warships. The installation of Diesel engine generators will be watched with great interest because it marks another important success in the various steps in the evolution of naval engines. The Navy designed and built the first large ship with turbine engines about twelve years ago. The turbine marked an improvement in economy over the reciprocating engine but to attain its greatest efficiency the turbine must be run at a speed too high for the ship's propeller. Naval engineers, therefore, developed the geared turbine to meet this objection.

The U. S. S. *Neptune* was the first big ship in the world to be driven by a reduction gear. Then naval engineers designed and built the U. S. S. *Jupiter* which was the first big ship to have electric drive, and the U. S. S. *Maumee* which was the first big ship to have Diesel engine drive.

The next step in the development was the designing and building of the U. S. S. *New Mexico* in which oil burning boilers furnish the steam which drives turbine generators, which in turn generate electricity for use in electro motors, which drive the ship's propellers.

The next step will be the ship in which Diesel engine generators furnish electricity for driving the main propelling motors and for all other machinery in the ship, and in which boilers will be used only for heating purposes. The installation of the Diesel engine generators in the *Maryland, Colorado,* and *West Virginia* will provide for a thorough test of these generators under service conditions and this will enable naval engineers to develop better Diesel engine generators which will then be installed in the next ships the Navy builds.—*Navy Department Bulletin,* 4 September, 1922.

AERONAUTICS

A HALF YEAR'S CIVIL AVIATION.—The half-yearly report on the progress of civil aviation issued towards the end of the month by the Air Ministry, recorded little, if any, commercial development during the period from October 1. 1921, to March 31, 1922. A small increase in the number of passengers carried was accompanied by a large drop in the value of the goods imported and exported between this country and the Continent, and by a fall of over two-thirds in the number of out-going and incoming letters. On the technical and organization sides, however, a little progress was recorded in the report. In connection with signalling and navigation a system was introduced whereby in bad weather a pilot flying within a radius of about ten miles from Croydon can be informed of his position by means of a "sound locater" and wireless telephony. The combination of line and wireless telephony was successfully experimented with by connecting the Croydon control tower telephone by line to the wireless apparatus. By this means an office in London was enabled to speak directly with an aeroplane in flight. The arrangements made to permit of flying by night on the London-Paris route were brought to a state of completion sufficient to enable them to be put in use at short notice. These arrangements consist of various route lights and illuminated wind-indicating signs, and are constructed to operate for a year without attention. For use in foggy or misty weather an improved design of beacon

flare, giving an intensified color light, was evolved. The total sum for civil aviation included in the Air Ministry estimates for 1922-23 is £364,000, not counting £35,500 for the headquarters staff and £51,000 for the Meteorogical Office. Of this sum, £200,000 is to be applied to the direct assistance of approved firms operating cross-Channel air services. Under the hire-purchase scheme by which the companies can acquire machines built by the ministry, the sum to be received is estimated at £16,000.—*The Engineer*, 4 August, 1922.

AIRCRAFT APPROPRIATIONS, 1922-23.—The following sums were appropriated for Aviation for the fiscal year 1922-23:

Air Mail	$1,900,000
Army	12,895,000
Navy	14,803,560
N.A.C.A.	210,000
	$29,808,560

—*Aviation*, 7 August, 1922.

2,000 PLANES TO DEFEND U. S. Washington, Aug. 6.—A definite and comprehensive program to provide an adequate air defense for the United States has been worked out by the air experts of the army and navy and is ready in tentative form for submission to Congress whenever it is finally approved.

For months experts of the Navy's Bureau of Aeronautics and of the Army Air Service have been working out this program along separate lines but with closest co-operation, and it is now ready for the Navy and War Secretaries, who are expected to use it as the basis of their recommendations to Congress this fall.

With the realization that plans involving the expenditure at this time of many million dollars and the construction of from 1,000 to 2,000 new planes of all types would "die a-borning" while Congress still faces a nation-wide demand for economy, it is understood that a progressive program extending over several years, similar to the navy's 1916 building program, will be recommended.

Just how far the two services will go in seeking immediate funds is problematical, as this is a departmental policy that will be decided finally by the higher powers. This will depend somewhat on aviation developments abroad.

Ever since the bombing tests about a year ago, there has been a constantly increasing public interest in aviation, the aviation people say, and recent events again have brought it to the front. They point to the significance of the announcement Friday by Premier Lloyd George that England was to build 500 airplanes at a cost of thousands of pounds, it being understood that this was but a step in a gigantic aerial program. Another event was the successful exploitation of the torpedo plane, not only in our own navy, but by the British.

America's aerial program as tentatively drawn up by the army and navy experts can be summed up roughly as follows:

1. Provision for enough new planes to enable the Army Air Service to have 500 machines on each coast and approximately 1,000 planes at strategic points in the interior.

2. Detail of 2,500 officers and 40,000 men to the Air Service.

3. Construction of between 250 and 300 new airplanes for the two huge aircraft carriers into which two of the treaty-doomed battle cruisers are being converted.

4. Equipment of every fighting ship and many of the auxiliaries with an airplane, catapult and, whenever possible, landing gear, something like 300 planes being needed for this.

5. Quantity production of the deadly torpedo plane of the all-metal type as soon as the experiments being carried out demonstrate the most suitable type for use on ships.

6. A systematic development of landing fields at seaports for the fleet flyers' use, and the landing fields along definitely laid out aerial lines all over the country.

While this program would call for an initial outlay of many millions of dollars and an upkeep and replacement cost that would run into big figures, the aviation proponents stress the fact that this cost, while large, is insignificant when compared to the cost of $40,000,000 battleships, and that it is vital to the national defense that aviation be developed to the fullest.

Air service heads believe that the army's force should be strong enough to repel any enemy that might threaten an attack; that the definite burden of providing the first-line of defense, so far as land attack is concerned, rests upon the regular army; that sufficient force to enable the keeping of 500 planes on each coast and 1,000 in the interior should be provided; that a definite system of airways should be established throughout the country, with established landing fields and supply stations at regular intervals; that emergency landing fields be made at frequent intervals, utilizing cow pastures or other available sites, but marking them and registering them on maps for use by all flyers, and plans for speedy transportation of supplies by air in a war emergency.

At present the air service has something like 600 planes in active service. In addition to planes being constructed and those that could be put back into service in case of necessity would run the number up to more than 1,000. Eventually the plans drawn up would double that number of serviceable planes and considerably more than double the officers and men now in service.—*Baltimore Sun*, 7 August, 1922.

NAVY PLANE FLIES WITHOUT A GUIDE. Washington, Aug. 24.—A new type of seaplane which is almost capable of flying without a pilot, has been delivered to the Navy Department. The plane, designed for the training of student aviators, combines safety features never before equalled in aircraft, navy officers said, with qualities of speed and maneuverability.

It was delivered at Anacostia after a successful 700 mile flight from Ogdenburg, N. Y.

"In testing the plane the pilot released the controls, taking his hands and feet off of them," said Commander T. G. Ellyson, of the Bureau of Aeronautics, who brought the craft to Washington.. "The throttle was cut to low speed and the plane went into a long glide. He then speeded up the engine and, still without the control being touched, the plane leveled off and continued in normal flight.

"Finally the engine was speeded up with the throttle wide open. The plane began to climb. She fell off on one wing and dived until a speed of 100 knots was registered, when the plane again leveled off in normal flight. During the entire demonstration, the pilot, Lieutenant Nielson, did not touch the control.—*Detroit News*, 24 August, 1922.

AIRCRAFT IN NAVAL WARFARE.—Owing to the fact that somewhat exaggerated accounts of the effects of the attack on the Atlantic Fleet by torpedo-carrying aeroplanes, recently carried out in the presence of His Majesty the King, have been circulated, the Admiralty has issued a statement explaining that the attack was arranged more with regard to spec-

tacular effect than as a critical experiment in methods of naval warfare. The element of surprise was entirely lacking, and the attack was quite undisturbed by any counter-offensive action on the part of the naval vessels. The conditions were thus entirely favorable to the aircraft, but in spite of this fact, the number of hits obtained on the battle line was small, and of minor tactical importance. It should thus be apparent that since the conditions of the attack bore so little resemblance to those existing in actual warfare, no useful conclusions as to the effect of this class of aircraft on the security of the Fleet can be drawn from these exercises. —*Engineering*, 28 July, 1922.

BOMBING THE "AGAMEMNON."—As a spectacle the aircraft tests against the *Agamemnon* last week were very impressive, but they have not done much to settle the battleship controversy. The number of bomb hits that were registered at 8,000 feet was only three per cent, and as this probably represents the minimum height to which aircraft operating by daylight could safely descend in the face of intense fire from A.A. guns, the bomb menace would seem to have been exaggerated. The experiment also showed that bomb-dropping at any considerable altitude is still very unreliable, despite reports of the invention of highly efficient bomb sights. The point-blank attack delivered by four *Snipes* was rather more suggestive. Had it been made by more machines and with "live" bombs of heavy caliber the damage inflicted must have been serious. Short-range attacks of this kind are a possibility in future warfare, especially under cover of darkness, when the bombing planes might be preceded by other machines dropping flares, which would illuminate the target without revealing the assailants. In such circumstances anti-aircraft fire would be of doubtful utility. On one point all the spectators of the recent test were agreed, namely, that the aeroplanes were handled with remarkable skill and dash. Further trials will shortly be held, this time to determine the actual effect on the ship of bomb bursts above and below the water. If the missiles used are at all powerful the *Agamemnon* should prove an easy victim, for she is an old ship with protection that falls far short of the modern standard.—*Naval and Military Record*, 16 August, 1922.

ALL-METAL AIR FLEET FOR GREAT BRITAIN. London, Aug. 18—England's fleet of 500 airplanes which the Government decided to authorize early this month will consist largely of all-metal machines, and when the total number is completed this country probably will have more than twice as many planes of this type as any other nation. Four of the models to make up the backbone of British air defenses are likely to be flying boats, which are smaller and speedier both as a fighting and troop carrying plane, and are capable of accommodating twenty-five soldiers each. Experimental planes of these types already are well under way and British producers say they have perfected construction methods by a scientific study of stresses and strains which have enabled them to construct frames much stronger than those heretofore made.

The discoveries actually are the result of war co-operation, when the bigger plants constructing airplanes were given the service of Oxford and Cambridge scientists for research work. Most companies have continued that collaboration, which has resulted in some improvements that have been carefully watched and reported on by United States naval and military forces.

The air ministry is not yet satisfied that the ultimate has been reached in the development of metal airplanes and machines, which, when virtually completed, will be subjected to tests twice as rigid as those for wood and fabric planes, in order to discover where their weakness exists so as to overcome such defects.

Because of those experiments it is not the intention of the Government to place the contracts for all 500 planes contemplated at once, but build up the fleet gradually, embodying all the improvements brought out as the tests progress.

Another factor which must be taken into account for some of the delay is that many manufacturing plants since the war have decreased their facilities for the production of planes or accessories and are unwilling to expand those tremendously for just a short period, preferring to take the work as slowly as their present facilities will permit.—*Boston Evening Transcript*, 18 August, 1922.

SETS NEW GLIDER RECORD. Berlin, Aug. 25.—A new record for sustained flight in a motorless airplane was set yesterday by Herr Hentzen, student flyer of the Hanover Technical School, when he remained in the air more than three hours. The flight was made on the concluding day of the gliding competition held in the Rhoen mountains, near Gersfeld. Hentzen's machine landed 350 metres above the starting point.

Hentzen is the flyer who startled the world of aviation last Saturday by remaining in the air two hours and ten seconds, breaking all records by a considerable margin.—*Boston Evening Transcript*, 26 August, 1922.

AMUNDSEN DEFERS FLIGHT OVER POLE UNTIL SPRING. Nome, Alaska, Aug. 29.—Captain Roald Amundsen, Norwegian explorer, has definitely abandoned for this year his plan for an airplane flight from Northern Alaska across the North Pole to Spitzbergen or Grant's Land, but plans to hop off next spring, it became known today, with the arrival here of the Coast Guard cutter *Bear* from Point Barrow.

Captain Amundsen told the correspondent of the Associated Press, who joined the *Bear* at Point Barrow, that the start had been delayed by unfavorable ice conditions and that the season was too far advanced to permit success.

Captain Amundsen landed his plane and equipment at Wainwright, 100 miles southwest of Point Barrow, and will make that point the base for his flight.

Radio advices from Captain Amundsen's exploration ship *Maud* indicate the vessel is frozen in the ice near Wrangel Island. The explorer expects to rejoin the *Maud* by airplane some time next year.

Ice conditions in the Arctic off the Northern Alaskan coast are the worst in many years. Captain Cochran, of the *Bear*, guided his vessel for miles through tremendous ice floes, reaching Point Barrow with difficulty.—*Baltimore Sun*, 31 August, 1922.

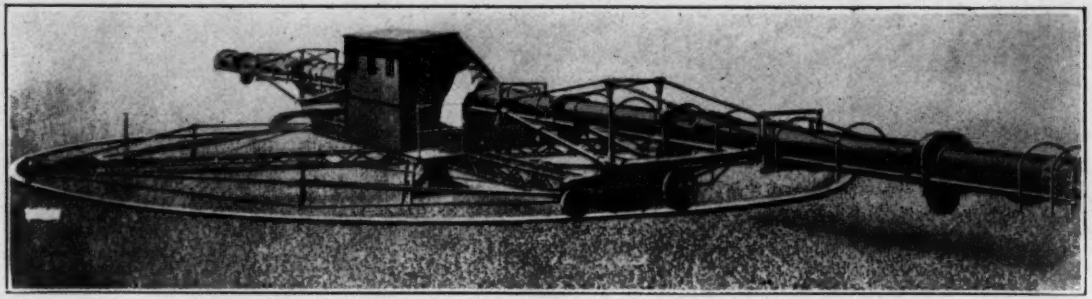
ORDNANCE

NEW MACHINE GUN RECORD SET BY NAVY PLANES.—A world's record with machine guns was made by naval fliers in the annual target practice of the air force of the Pacific fleet recently completed, according to a report received by the Navy Department from Captain H. V. Butler, commander of the air craft squadron.

Hitherto a hit every two seconds was considered excellent shooting with a fixed machine gun. Three of the naval fliers in the recent tests scored the phenomenal average of 123 hits in twenty-two seconds. This record was established by pilots of the fighting plane squadron.

The machine guns used were of the Vickers type synchronized to fire through the propellers. These guns are on fixed mounts and are aimed at the target by maneuvering the plane.

Lieutenant G. Cudhay scored 145 hits in 27 seconds. Lieutenant L. Hewett hit the target 137 times in 18 seconds, and Lieutenant W. B. Gwin landed 87 hits in 21 seconds, making the average of 123 shots in 22 seconds.—*Boston Evening Transcript*, 30 August, 1922.



THE LARGEST RANGE-FINDER. BUILT FOR BRITISH COAST-DEFENSE WORK. IT IS 100 FEET LONG AND IS SAID TO GIVE ACCURATE READINGS UP TO A RANGE OF 22 MILES

—*Scientific American*, September, 1922.

BRITISH TORPEDOES FOR USE WITH TORPEDO PLANES.—A minor though not unimportant question raised in the discussion concerns the type of weapon used by our present torpedo planes. Viscount Curzon says it is a 14-in. model of a very unreliable kind, with a maximum range of one thousand yards. If this be true, we are far behind the Americans, whose latest planes carry a 21-in. torpedo with a powerful warhead. Great length of range is not essential in torpedoes designed for air carriage, since the nature of the attack postulates delivery at comparatively close quarters. If our torpedo planes are unable to carry large torpedoes it means that they are of obsolete design and should be replaced by machines of a modern type. Part of the Air Ministry's £11,000,000 might be profitably expended in this way.—*Naval and Military Record*, 26 July, 1922.

THE ELECTRIC GUN SHRINKING FURNACE.—Up to January 15, 1920, all tubes, hoops, jackets, recoil bands, etc., assembled at Watervliet Arsenal were heated in an oil-fired furnace to the required temperature. The temperature to which the various forgings are heated is the lowest temperature which will provide sufficient expansion to take care of the shrinkage allowances on the male piece and provide sufficient clearance for the ready assembly of the heated forging. The temperature to which the forgings are heated is seldom in excess of 800° F. and must always be less by a safe margin than the last annealing temperature used in manufacturing the forging which is under consideration so as not to affect its physical properties. The last annealing temperature is usually between 1,000° and 1,200° F. so that 800° F. is considered a safe temperature to heat all gun forgings to.

In heating a gun forging to secure the required expansion it is absolutely necessary that it be uniformly heated throughout and not too rapidly. In order to accomplish this result, it is imperative to heat the forging without having the flame come in contact with it. It is also desirable to have control of the temperature at different points in the furnace so as not to overheat or raise the temperature of the thinner sections of the forging too high while heating the thicker sections of the forging to the desired temperature.

The oil-fired furnace which used crude fuel oil consisted of a boiler plate cylinder, lagged on the exterior with an asbestos covering to provide heat insulation. Inside of this cylinder there was a wall of fire brick. Next came the fuel and air pipes of the furnace proper, the fuel and the air at about forty pounds pressure per square inch being fed through the oil burners. The fuel feed pipes consisted of four vertical pipes running the entire length of the furnace. Auxiliary feed pipes consisting of cylindrical rings were connected to the main feed pipes every five feet. Four oil burners were attached to each cylindrical feed pipe, the burners on the alternate feed pipes being located one-half way between the burners on the feed pipes adjacent to it so as to stagger the burners and not concentrate the heat in a vertical line. Valves controlling the flow of fuel and air were brought to the outside of the furnace.

The oil-fired furnace was very unsatisfactory in that it was necessary to light the burners individually and to adjust the air and oil on each burner if a change in temperature inside the furnace was desired. It often happened that during the heating of a large forging (which in some instances requires as much as twenty-four hours) the burners would become dirty and refuse to burn longer so that it was necessary to have men in constant attendance, climbing around the outside of the furnace in order to keep the burners adjusted and burning properly.

A cylindrical baffle of three-eighths inch boiler plate was provided for the inside of the entire furnace so that the flame from the burners would play on the baffle plate, thereby preventing it from coming in contact with the

forging which was being heated. The flame on the baffle plate was directed at an angle so as not to heat it red hot and burn through.

All forgings were supported from the bottom of the furnace. No forgings were ever suspended from the top of the furnace, as the construction was such that sufficient strength could not be readily provided to accomplish this desirable feature.

On January 15, the oil furnace collapsed and it was necessary to repair it immediately or to install the new electric furnace. The latter course was decided upon and since it was expedient to complete the installation at an early date, in order to avoid stoppage of all work on the manufacture of 14-inch and 16-inch guns, three-shift operation was authorized and the new electric furnace was completely installed and ready for operation in April, 1920.

This furnace is composed of thirteen sections, each section being approximately 6′ 8″ inside diameter, 10′ 5″ outside diameter and 5′ 6″ high; each section requires sixty-eight kilowatts at normal voltage, giving the entire furnace a rating of eight hundred and eighty-four kilowatts.

The actual depth of the furnace is 72′ (each section being a complete mechanical and electrical unit) and operates on a 3-phase, 220-volt, 40-cycle circuit at unit power factor. Power is supplied to the furnace from an 11,000-volt, 3-phase, 40-cycle transmission line connected to three step-down, oil-cooled, oil-insulated, outdoor type transformers of 400 k. v. a. capacity each. The transformers have an 11,000-volt primary winding and a 230/460 volt secondary winding, being connected in series multiple on the low voltage side, the connection being 3-phase delta.

The secondary winding of the transformer consists of four 115-volt coils, the coils being connected in groups of two inside of the transformer to form two 230-volt windings, four cables are brought through the transformer permitting a series connection giving a voltage of 460 volts or a series multiple connection giving a voltage of 230 volts, the latter voltage being the one used in operating the furnace.

Power is conveyed from the transformer busbars to the switchboard through three one million circular mil, extra flexible, varnished cambric cables, there being located on the switchboard three single pole air brake circuit breakers. The switchboard is provided with current and voltage transformers for operating a graphic meter installed on the board. There are located on the switchboard eighteen automatic contactor switches, one contactor switch being required for each section of the furance. The extra five contactor switches are used for operating a smaller electric furnace similar to the one described but which consists of only five sections, being used for shrinking of smaller cannon.

A control room is provided having one panel for each section of the furnace, each section having a triple contactor switch electrically operated by fuses. On each panel there are mounted two ammeters; ammeters being provided for two of the three phase lines. Current transformers are mounted on the rear of the main switchboard. On each control panel there are also mounted two indicating watt-meters, indicating the load on each section of the furnace. Toggle switches mounted on a desk-like panel placed directly in front of the recording pyrometers are so located that the operator does not have to move in order to operate the contactor switches placed on the main switchboard. With this arrangement he is able to cut off or turn on the power on any section of the furnace as required. Each section of the furnace is provided with two adjustable thermo-couples located on opposite sides of the section, one being located near the bottom of the section and one near the top.

The sections are arranged so that the thermo-couples are staggered throughout the entire length of the furnace. The thermo-couples are adjusted so that they actually come in contact with the metal of the gun

or forging which is being heated. The temperature readings of the twenty-six thermo-couples are recorded in thirteen minutes automatically by a Leeds & Northrup recorder. There are two Leeds & Northrup recorders, each one recording the temperature of thirteen thermo-couples.

Each section of the furnace being a separate mechanical and electrical unit makes it possible to remove any section (simply by lifting it off with a crane) and use it as a separate furnace at any convenient location.

A structural steel and iron inner and outer frame is provided as a part of each section, being so constructed that the outer frame carries the entire weight of the other section of the furnace assembled on top of it. The outer frame is insulated from the inside of the furnace by a wall of heat insulating brick so as to eliminate any possibility of the outer frame being heated to a temperature which might distort it. The inside of the furnace is built up of cast iron, planished iron, and calorized steel parts, none of which are attacked by a temperature of 1,000° F. or less. 1,000° F. is the temperature at which the furnace is rated. The inner structure is not connected to the outer frame by any through bolts or through metallic parts and it is therefore free to expand in diameter or length without disturbing the outer furnace frame.

The heating element or resistance unit consists of a calorite ribbon approximately 1/3" wide made up into units of about 20' lengths, each unit being complete with its insulator and cast iron supporting plate.

Figure 2 shows the heating units assembled and the open door which is usually provided on the lower section of the furnace. This illustration also shows the calorized guard rods which are assembled on a flange in front of the heating units which are provided to prevent the possibility of injury when lowering a gun or forging into the furnace. The calorite ribbon with which the heating unit is wound is a nickel alloy consisting of approximately seventy per cent nickel; twenty per cent chromium and ten per cent iron and can be run at a temperature of 1,800° F. in air without apparent depreciation. The insulators themselves are made from a special alundum compound having great mechanical strength and electrical resistance with the ability to retain both of these properties at a temperature considerably above the operating temperature of the furnace. The insulators with the heating unit have been repeatedly heated to a temperature of 1,300° C. and quenched in oil or water without crazing. This latter feature is of the utmost importance as in a shrink pit an accident is liable to happen which might flood the bottom of the furnace with water.

The top section of the furnace is provided with a split cover, the halves of which move aside to allow the forging to enter or emerge from the furnace. This feature permits the suspension of a gun or forging from a fixture provided with a suspending shaft extending through the center of the cover and supported on I-beam girders on the outside of the furnace. These girders are on rollers and can be moved out of the way when not required. The heating units being located on the inside of the furnace, the heat will be transferred from them to the charge largely by direct radiation. The heating units operate at a comparatively low temperature (only 100° to 200° above the temperature of the charge) as compared to that of the baffle oil type furnace in which the charge must be first heated through the walls of the baffle. The heating unit is located far enough away from the walls of the furnace so that it can readily dissipate its heat and, being of such small cross-section, heats very rapidly. The fact that the furnace is made in sections permits it to be readily assembled or disassembled to any desired height by simply adding or removing sections.

Sets of heating units are connected to each phase of a 3-phase circuit so that two or more sections of the heating unit constitute a polyphase unit which gives a balanced load on the power circuit. One of the outstanding

features of the control is that it permits controlling from the heat unit, which is a body of small mass, and maintaining there just enough temperature to supply the radiation losses of the furnace and gives the required temperature to the charge. This may be called an indirect control and has very marked advantages. One advantage is the arrangement of the contacts whereby the resistor can never reach a temperature sufficient to cause damage to itself, which affords protection against burnouts in case of abnormal voltage; and, which is equally important, no part of the charge can become overheated for the reason that all heat which enters a body must pass through its surface and, as the surface temperature cannot exceed the setting of the instrument, it follows that no part of the charge can be overheated.

The fact that accurate control of the temperature is possible makes this type of furnace very efficient, as it is possible to graduate the temperature from end to end as required for the different thickness of the forging. The absence of noise, heat, smoke and products of combustion, with the ability to locate the furnace in any part of the shop, are great advantages which can be obtained when using this equipment. The necessity of the transportation and storing of fuel oil is also eliminated. It is found that at present the electric furnace can be operated approximately fifteen per cent cheaper than the oil furnace, this percentage not taking into consideration the maintenance and upkeep of oil storage facilities.—*Army Ordnance*, July–August, 1922.

RADIO AND NAVIGATION

NEW RADIO EQUIPMENT FOR LAKEHURST.—The two largest airships in the world, now building for the Navy, one at Lakehurst, N. J., and one in Friederichshafen, Germany, will have the latest and best radio equipment capable of development. Anticipating their completion, their home port is being fitted up for their arrival with a high-powered radio station.

A new type of radio transmitting antenna without towers has just been installed at the naval airship base at Lakehurst, N. J., Naval Radio Station NEL. In an effort to keep the big landing field clear for the two big rigids *ZR 1* and *ZR 3*, and to eliminate high towers and aerials, the radio engineers of the Navy designed a long low aerial. It is nearly 800 feet long and fully 120 feet wide, forming a sort of gridiron, which is mounted on poles only 60 feet in height instead of between 150 and 200 feet. Technically it is a multiple-tuned antenna with several ground leads. By erecting the aerial along one side of the field, a clear open space is left for maneuvering the ships.

Recent transmission tests with the new aerial have carried messages on 900 meters to Newport, R. I., and Norfolk, Va., distances approximating 200 and 250 miles, which indicates excellent daytime service. Daytime communication with the big airships when they are cruising within about 300 miles of the station is promised. At present, a vacuum transmitting set with 1 KW in the antenna is used, and the experts believe that on clear nights in winter communication can be carried on with aircraft or ships fully 2,000 miles out on the Atlantic. This will insure the picking up on the German-built *ZR 3*, on her maiden trip to her home port, before she is a third of the way over. When the *R 38* made her initial trans-Atlantic cruise, she was not heard from until within about 600 miles of New York.

The new aerial was designed and built by the Naval Aircraft Radio Laboratory at Anacostia, and installed at Lakehurst by radio men from the Philadelphia Navy Yard.

In addition to the new radio transmitting set, Lakehurst will have a radio compass station which will enable the airships to determine their position in the air within a radius of 200 miles, and locate the field when

returning from a cruise in darkness or in dense fog. Radio equipment for the big rigid ships has not yet been designed, but it is understood that as plenty of room will be available for engine-driven generators producing great transmitting power, a very long range set can be installed, and it is hoped that both radio telegraph and telephone communication can be carried on up to 300 and 100 miles respectively.—*Aviation*, 21 August, 1922.

THE RADIO TELETYPE.—The sending instrument of the teletype is mounted in a standard type of Navy plane. It resembles in general the commercial typewriter. Each key is connected to the radio installation in the plane and when a letter is struck on the keyboard a radio impulse is sent out and is received at a station on the ground. The similarity to the typewriter is completed in the equipment of the receiving end of the device. When, for example, the letter "A" is struck on the keyboard in the air the radioactive energy released travels to the recording instrument and selectively energizes the type-letter "A," causing it to be reproduced on paper carried in the receiver.

The teletype has been in use for eight years in connection with land wire operations, but its application to radio use is a recent development and the present tests now going on at the naval air station are the first that have ever been conducted in aircraft. Within the past year successful tests were carried on with the teletype operated by radio between the naval air station at Anacostia and the Bureau of Standards in Washington, a distance of nine miles. This laid the foundation for further work in connection with airplanes.

As the tests are carried on at present the transmitting instrument of the teletype is mounted in the plane and the receiver is located on the ground at the station, but experts who are carrying on the work point out that a reversal of this operation, where the recording instrument is carried in the plane and messages are sent out to it from the ground stations, is a development merely involving detail.—*Army and Navy Journal*, 12 August, 1922.

RADIO TRANSMITS PHOTOGRAPHS.—The cut shows a reproduction of thumb prints transmitted by radio in ten minutes.—*Boston Evening Transcript*, 22 August, 1922.

LINER "ORBITA" FIRST TO USE LEADER GEAR CABLE.—To the Royal Mail Liner *Orbita* has fallen the distinction of being the first ocean-going

steamer to be navigated into port with the help of the British Admiralty's twenty-mile long submarine cable, which runs from the entrance to the narrow channel leading to Portsmouth well out to sea. The vessel is fitted with the special electrical apparatus necessary for a ship's navigation by such a cable and was guided into port with its aid during foggy weather in the early part of July, while homeward bound from New York to Southampton. By listening to a succession of Morse "V" signals sent over the cable by an operator on shore and steering to port or starboard according as the sounds grew faint or louder, the officer on the liner's bridge was able to steer her safely to her destination although the weather was very thick.

Commenting on this performance of the *Orbita, Shipbuilding and Shipping Record* says that the day may come when the busy traffic of our estuaries may be carried on safely in foggy weather by means of "in" and "out" cables. It is likely to prove a matter of some difficulty to secure the cable against lateral motion in the case of sandy estuaries where silting currents are at work. Having regard to this and other objections, of which the initial and upkeep costs may be mentioned, it seems unlikely for some time to come that this method of navigation will supplant that time-honored institution, the pilot.—*Nautical Gazette*, 5 August, 1922.

MISCELLANEOUS

DISCUSSION AT INSTITUTE OF POLITICS. Williamstown, Aug. 19.—The five-minute speech made here yesterday in regard to the Washington Conference by Rear Admiral W. L. Rodgers, chairman of the executive committee of the General Board of the United States Navy, stands forth in the minds of many members of the Institute of Politics today as one of the most dramatic episodes which has yet developed during the Institute's entire session. By singling out the admiral's comment for special attention, I in no wise intend to disparage the interest of any other address made at yesterday's meeting of the round table on "Problems of the Pacific." The prospects which the Washington treaty have opened in the future were assessed ably by the leader of the round table, Professor George H. Blakeslee of Clark University, and its achievements were challenged as forcefully by Oscar T. Crosby, eminent engineer and formerly Assistant Secretary of the Treasury. The fact remains, however, that as Admiral Rodgers threw the great weight of his professional authority, now into the scales, with Dr. Blakeslee, and now into a balance that fell against the scholar's judgment, from this very process the admiral's speech gained notably in significance.

Mr. Crosby was first to draw the opposition of the General Board's executive leader. "In limiting armament at Washington," Mr. Crosby had said, "the nations of the world gave up only that portion of their naval armament which had ceased to be of vital importance, namely, battleships. The situation," he continued, "suggested an analogy of the knight of old who found his armor too heavy to bear and who lay where he fell, unable to move, while the newly devised methods of the Swiss infantry won the battle sixty yards ahead of him.

"I regret to say therefore that I cannot agree that we have scrapped competition in naval armament, because there is ever with us the inventor. He never sleeps, and after all that has been done regarding the scrapping of dreadnaughts, he is already at work finding means to make weapons which will conform with the Washington agreements and yet be as powerful and as deadly as ever. I have been among the Thibetans, who carried muskets as long as this table, but with the small rifle which I carried I could have shot them down like rabbits. The inventor had been working for me, and he had not been working for them.

"The inventor is working for all the nations in naval armament today, and there has been no 'scrapping' of the competitive principle in the preparation for war, on the contrary, the Washington agreements have left out of the reckoning the very agencies which will be the determining factors in naval warfare of the future."

To this view of the case Admiral Rodgers' opening words came as a categoric negation. "It is the concensus of responsible naval authorities of all the world that the battleship is still the backbone of the fleet, not often used, but holding the ultimate decision."

Here the General Board's opinion evidently went along with Professor Blakeslee's view, expressed in his opening statement to the round table, that the Washington Conference had indeed achieved a substantial international limitation of armament for the first time in history.

Professor Blakeslee's whole address, by the way, was a master-piece of confident and well-expressed definition of the contributions which, after service in the conference as one of the American Government's technical advisers, he believes that the Washington Treaties have made. Paying high tribute to Secretary Hughes, the leader of the round table declared that the Washington Conference "has overthrown British supremacy of the seas and placed on a naval equality the British Empire and the United States. It has strengthened and solidified American-British friendship. It has settled many controversies in the Far East, and placed the others on the road towards settlement."

Upon at least one point of major importance these remarks met dissent from Admiral Rodgers. He said he could not altogether agree with Dr. Blakeslee as to the renunciation of naval supremacy by Great Britain. "Until the United States has a merchant fleet of its own, carrying its products to all the world, without fear of or reliance upon foreign shipping, the British position upon the high seas will be unrivaled in peace and war," the admiral declared.

But the text of the first public pronouncement which the chairman of the executive committee of the General Board of the United States Navy has made upon the subjects in question, since he sat throughout the Washington Conference at the elbow of the American Secretary of State, is worth giving in full.

"It is the consensus of responsible naval authorities of all the world," said Admiral Rodgers, "that the battleship is still the backbone of the fleet, not often used, but holding the ultimate decision. It is not a finished product of invention but still capable of improvement within the limitations of the treaty. To use an army analogy, in the army the infantry arm is the queen of battles to which all other arms are indispensable but still secondary. So with the battleship it is the ultimate arbiter of naval war when and if duly supported by all auxiliary naval types of shipping, including aircraft.

"As to the Washington Conference—at that conference the United States made all the material sacrifices in strength. We hoped in reward, therefore, to gain corresponding advantage in the moral imponderables. While it is now certain as to what we sacrificed, what we hope we have gained lies in the future. We shall not know for ten years. As Mr. Lodge said in the Senate, it is a great experiment, the imponderables of the future, on which we have based our experiment were not worthy of confidence before the war. Before the war the world did not estimate highly the idealism of the potential strength of the United States.

"The United States was inclined to be very civil and forbearing internationally, and other Powers thought they might presume on our forbearance. But the war let the world know that the United States was great and powerful and her anger when aroused was terrible; we appreciate, too, our own economic strength and we appreciate, too, the

economic weakness of Japan as well as her change of front which we have so eloquently put before us, as originated in the ministry of Mr. Hara and continued by Baron Kato who made himself regarded with so much personal esteem and sympathetic feeling in Washington.

"These are the imponderables which justify our sacrifice of material naval strength.

"But we must not sacrifice a full measure of material naval strength as our first line of defense behind which we may develop our potential force in the actual force to make righteousness prevail. Mr. Roosevelt urged that we 'go softly and carry a big stick.' We did carry a big stick in the war and swung it easily, and the world knows it. Henceforth, we may carry a stick, less than the biggest, because the world knows we can swing the biggest and will do so if occasion arises. And so our limitation of naval armament is justified but, as Mr. Hughes pointed out, the conference was to limit only, not to abolish armaments.

"As for our chairman's remarks to the renunciation of naval supremacy by Great Britain, hitherto mistress of the seas, I do not think I can altogether agree with him. The absolute terms of the treaty so far as they go, look to equality; but the naval strength in certain types of ships remains open as before. We may fairly expect the spirit of the treaty to prevail to cause the cessation of competitive building in these types also. But in its merchant fleet the British fleet with its business support, as yet remains unapproachable.

"As the world develops in industry and transportation and as industries specialize regionally, ocean transportation as a basis of national wealth and power increases. Naval combatant strength exists chiefly, if not solely, to back ocean commerce, to route and control ocean traffic, in war as its duty, in peace strategy, it follows and supports the flag of national commerce.

"The United States is developing more and more every decade its foreign business, and the high standards of living of the American people depend more and more upon uninterrupted ocean traffic. It is by its combination of naval strength with merchant shipping strength that England has arrived at its dominant position as a world power. Until the United States has a merchant fleet of its own, carrying its products to all the world, without fear of or reliance upon foreign shipping, the British position upon the high seas will be unrivaled in peace and war.

"The open door, spoken of so often at this institute, in the past month and in so many forums, should be utilized by United States carriers by shipping for men and goods, and by cables, radio and mails for news and business."—*Boston Evening Transcript*, 19 August, 1922.

EUROPEAN NAVAL NOTES.—There is a very pretty row going on in the British Government as to the future of naval flying. Admiral Beatty and Lord Lee are voicing the opinion of the service when they insist that the Navy shall have its own aeroplanes and flying men, but the Treasury is standing out in the matter, apparently on the ground that if the price of an air service is added to the two capital ships which are to be laid down early next year it will make the estimates of the three services appear unequal and folk will be imagining that the Navy is being unduly favored at the expense of the Army and Air Force.

There are two main points on which the Navy objects to being under the thumb of the Royal Air Force, and as they are material and personnel it does not leave much room for satisfaction. As regards the supply of material, one has only to turn up the history of the days when the Ordnance Board supplied both the Army and the Navy with artillery, to find an exact parallel, and no more melancholy chapter in the history

of our fighting forces exists. As to the present condition, figures were officially published which gave the number of each type of machine allotted to the navy, and it was at once seen that they had practically none at all. Then the Air Force published other figures to show that there were really ever so many more ready for naval use, although the Admiralty apparently knew nothing about them. The poor general public is now wondering just where it stands and who is pulling its foot over the figures.

As for the personnel side, the issue is quite straight-forward and will appeal to every sailorman. At one time there was a Royal Naval Air Service, but that was swept away during the war and officers and mechanics of the Royal Air Force appointed to H. M. ships. Then the trouble soon began. The two forces had totally different traditions and ways, and there was nothing but friction forward and aft. Now the navy has landed practically all its aeroplanes from the men-o'-war in order to be free of the trouble, which threatened to become really dangerous to the efficiency of the ships. There is bound to be something of this sort whenever men who are not of the navy are crowded into the cramped spaces of a man-o'-war and placed under naval discipline with reservations. Several young flying men who were inclined to be fresh caused a lot of bother by playing off one service against the other when it came to matters of discipline and work, and there is still the old outstanding sore that they refuse to do ship's duty when embarked, and are backed up in that attitude by their superiors. Thus it happens that the wardroom of a ship that carries R. A. F. men is in a constant state of irritation because there are one or two members of the mess who have nothing better to do for the greater part of the day but drink gin and bitters. And when it comes to naval air work, they are not really fit for the job, because, not being watchkeepers, not all of them know the sharp end of a ship from the blunt, and most of them would be very hard put to it to distinguish between the various classes and lines of merchantmen. What the fleet wants is a flying officer who will revert to ship's duties as soon as his flying life is over and an engine room artificer who shall be as efficient as his class and leave the service with a string added to his bow in the search for civil employment.

To get on to more serious topics, the bombing experiments on the obsolete battleship *Agamemnon* have taken place and have given rather interesting results. They were not intended in any way to show the power of aeroplanes to destroy men-of-war, merely to demonstrate the ability of the airmen to hit the target. Nine-pound smoke bombs were used, which showed up clearly whenever they hit anything, whether it was the ship or the sea. The battleship was fitted with oil fuel so that she could maintain steam without any crew, and was steered by wireless from a destroyer about three thousand yards away. She could be whacked up to fifteen knots without the least difficulty and twisted and turned about in all directions, but practically the whole day was spent ambling along at an easy ten and steering practically a straight course.

Considering that there were a lot of press men and politicians watching the experiments, among whom there is a very distinct tendency to say that the battleship is doomed and that the authorities are criminally foolish to lay down the two new battle cruisers, it is very difficult to see what was the idea of the Admiralty in making the tests so ridiculously easy for the airmen when they had the power to make it approximate somewhat to the conditions that would obtain in wartime. Possibly to spare their feelings. Now we are flooded with well-meaning people who do not know the sharp end of a battleship from the blunt, but who insist on telling us how the navy ought to be scrapped. As a proof of their theories they quote the *Agamemnon* experiments and treat them as final,

with the result that the Admiralty has doubled the difficulties in its path of following the policy to which it has set its hand and which is certainly the best for the country. However, the harm is done now.

The experiments themselves were quite interesting as far as they went, but, needless to say they only touched on the fringe of the problem and must be followed by many more—without an audience. At 8,000 feet four *de Haviland* machines dropped a total of ninety-six bombs, of which two appear to have hit the target and one to have been a little doubtful. The percentage of hits is not high, and when one converts the nine-pounder bombs into missiles of sufficient weight to do much damage to a man-of-war it means that to score those three hits a big air squadron and a huge base organization would be necessary. Had the ship been zigzagging at twenty-five or thirty knots instead of ambling along a straight course at ten, it is difficult to guess what the percentage of hits might have been. Then four small *Snipes* got in and descending to very little over the ships' trucks dropped forty-eight bombs in all, scoring hits with all but three. This was all very well as far as hitting was concerned, but what of the aeroplanes if the target had a crew on board with anti-aircraft and machine guns? Then a flight of *Camels* swooped down and peppered the *Agamemnon's* decks with machine gun fire in a way that must have made them very uncomfortable and proves the necessity of shields for the anti-aircraft armament. After that the range was increased to eight thousand feet again, at which three *de-Havilands* scored five hits out of seventy-two and two *Handley-Page* machines scored a single one with sixty-four bombs. Altogether one cannot help thinking that the war at sea would have been almost comfortable had the proportion of hits to misses always been as low as that.

Even closing one's eyes to the fact that the pilots had been through a special intensive course of bomb-dropping and even with everything in their favor could do better than that, it remains to be asked what harm so few hits are likely to cause a well-protected ship. At Jutland our capital ships stood many more big shells, and the experiments which the United States Navy carried out all suggest that a bomb is not such a dangerous missile as a shell. But the conditions having been made very easy and the airmen having contrived to score a few hits, there are many laymen who are quite satisfied in their own minds that the battleship is doomed. As all these good people have votes there is more trouble ahead of the Admiralty to convince them that the Board is not sticking to the big surface ship merely for the sake of keeping themselves in jobs. —F. C. Bowan, Late Captain Royal Marine, in *Our Navy*, 20 August, 1922.

SCRAPPING OF SHIPS BY ENGLAND AND JAPAN. London, Aug. 23.—Great Britain is scrapping her capital ships "gradually."

Many people have had visions of dockyards, swarming with workers, dismantling the great gray ships alongside the quays, battering off guns and searchlight platforms, as if nothing else on earth mattered.

In England, at any rate, this is far from fact.

In the first place most of the heavy scrapping to be done by England, Admiralty officials showed, is not scheduled before 1925, when four super-dreadnaughts of the *King George V.* type come under the shipbreakers' hammer, or are sold, minus their armament and implements of warfare.

After that the famous *Queen Elizabeth* comes up for destruction in 1935, the *Royal Sovereign* in 1936, the *Renown* (already on the reserve list since the return of the Prince of Wales from his world tour) in 1940, and the famous *Hood* in 1941.

In the meantime sixteen obsolete vessels have gone to the scrap heap. They are the pre-dreadnaughts *Mars, Cæsar, Queen Swiftsure, Hindustan, Lord Nelson*, and the dreadnaughts *Bellerophon, Temeraire, St.*

Vincent, Dreadnaught (the original of her type), *Hercules, Inflexible, Indomitable, Crescent* and *Commonwealth.*

These ships, it is true, were partly scheduled for the scrap heap before the Washington Conference took place. The Treaty of Washington sealed their fate and they have accordingly been "scrapped." That is to say, they are no longer on the actual list of the navy.

Some of them have been broken up, others used as targets, others again, minus their guns, rest in the dry docks of Devonport and Portsmouth, rotting gradually with but a couple of caretakers on board—ships which were once the pride of the British fleet.

Of the latter types scheduled to go, and already off the navy's active list, are the *Superb*—in a few weeks to become a target for the bombs of British air squadrons—the *Erin*, already in the hands of shipbreakers; the *Agincourt, New Zealand, Princess Royal* and *Lion.—Baltimore Evening Sun,* 23 August, 1922.

London, Aug. 31—In accordance with the Washington naval agreement, the Admiralty has ordered six large capital ships scrapped. They are: battlecruisers, *Lion* and *Princess Royal,* sister ships, built in 1910 and 1911. Both are 675 feet long, displace 26,350 tons, and carry eight 13.5-inch and sixteen 4-inch guns. The *Lion* in 1911 smashed all speed records when she steamed 31.5 knots during an eight-hour full-power trial. The dreadnaughts *Orin, Monarch* and *Conquerer* are all of the same type and were finished in 1912. Each is 545 feet long, has a displacement of 22,500 tons, and carries ten 13.5-inch and sixteen 4-inch guns. The dreadnaught *Erin* was finished in 1914 and is 540 feet long, displaces 23,000 tons and carries ten 13.5-inch and sixteen 6-inch guns. All are among the most famous warships in the British Navy.—*Boston Evening Transcript,* 31 August, 1922.

Washington, Aug. 17.—Preparatory operations for carrying into effect provisions of the Washington treaty for limitation of naval armament insofar as they apply to scrapping of vessels, as announced by the Navy Department in Tokio, were made public tonight by the Japanese Embassy. The plans follow:

"1. *Aoki* and *Satsuma* to be transferred to Yokosuka, where they are to be scrapped.

"2. *Katori* and *Kashima* to be sent to Kure, where their turrets are to be landed, and then to come to Maizuru, where they are to be scrapped.

"3. *Kurama* to have her turrets landed at Kure and then to be sent to Sasebo, where she is to be scrapped.

"4. *Ikoma* to have her turrets landed at Yokosuka, and then to be sent to Sasebo, where she is to be scrapped.

"5. Part of operations preparatory to scrapping of war vessels to be scrapped under naval treaty, other than those mentioned in foregoing, to be carried out at naval stations to which they respectively belong.

"6. War vessels, preparatory operations on which, as above-mentioned, have been completed, are to wait for further order until coming into force of naval treaty."—*Baltimore Sun,* 18 August, 1922.

Tokio, Aug. 10.—As soon as the ratifications of the five-power naval treaty drawn at the Washington Arms Conference are exchanged by the United States, Great Britain and Japan, the Japanese Admiralty will put into effect plans already made for scrapping war tonnage under the naval limitation program. An Admiralty official explained that until these three powers take final action, Japan did not feel justified in scrapping a single new ship.

He said, however, that Japan was influenced by what France might be disposed to do.

A strong party here would favor making the five-power treaty a three-power one should France and Italy fail to ratify.

The Admiralty will announce soon the scrapping program. Reports of the vernacular press that the dismantling of the *Kurama* had begun are untrue.

Japan is eager for financial reasoning to carry out the terms of the treaty as quickly as possible. But the Diet has not yet voted money for the purpose.—*Baltimore Sun*, 11 August, 1922.

Washington, Aug. 10.—Although officials of the Washington Government are anxious that the naval limitation treaty shall come into force at the earliest practical moment, they so far have made no plans for an exchange of ratifications until all five of the signatory powers are ready to record formal approval of the pact.

To await action by France and Italy, as well as by Japan and Great Britain, it is pointed out, not only would be in accord with well-established diplomatic practice but would harmonize with the earnest desire for absolute and final consummation of the naval program laid down by the Washington Conference at the instance of the United States.

Three-Power Agreement Cited

Should Japan formally suggest an easier exchange of ratifications by the three powers, who are principals in the 5-5-3 arrangement, however, it is indicated that the proposal would receive careful consideration by State and Navy Department officials. In that connection it is recalled that the American, British and Japanese delegations to the conference agreed that the 5-5-3 ratio should stand as applying to the three powers, regardless of the policies of France and Italy, and it is not doubted that a three-power treaty on the subject would be possible should permanent obstacles block ratification of the five-power arrangement in France or Italy.

Thus far, however, department officials have received no advices which discourage them in their confidence in ultimate ratification by all five of the Washington treaty signatories. It is realized that other questions are agitating official circles in Europe, and it is assumed that in due time the naval pact will be given favorable consideration.

Only the execution of a formal certification by President Harding is necessary to complete ratification of the treaty by the United States, but it has been indicated that this step probably would not be taken until officials at the same time could set a date for exchange of all the ratifications. Meantime the American naval officials, like those in Japan, are making tentative plans to carry the scrapping program into effect.—*Baltimore Sun*, 11 August, 1922.

A SUPERPOWER SYSTEM FOR THE REGION BETWEEN BOSTON AND WASHINGTON.—The signing of the armistice providentially delayed a rapidly approaching power famine in the northeast manufacturing district of the United States. That there is a problem of power shortage to be faced sooner or later in that district, however, as population and industry increase, is indicated by the rapidity with which the development of war industries absorbed the available power.

A survey of the resources and needs of the region has recently been made under the direction of W. S. Murray, and the report has been published as "A Power System for the Region between Boston and Washington," *U. S. Geol. Survey Professional Paper 123*.

The territory in which the survey was made—the "superpower zone"—lies between the thirty-ninth and the forty-fourth parallels of latitude and

extends from the coast to approximately 150 miles inland, including parts of Maine, New Hampshire, Vermont, New York, Pennsylvania, Delaware, and Maryland and all of Massachusetts, Connecticut, Rhode Island, and New Jersey.—*Geographical Record*, July 1922.

HELIUM.—To date no one has succeeded in combining helium with any other element, or in inducing the gas to take part in any chemical reaction under any conditions. In this respect, it is similar to other rare gases of the atmosphere—neon, argon, krypton, and xenon. Helium is only slightly soluble in water. Its thermal conductivity is fairly high, but it is less than that of hydrogen. A volume of helium weighs about twice as much as an equal volume of hydrogen, under identical conditions of temperature and pressure. It is a good conductor of electricity, being next to neon in this respect. Under similar conditions it conducts a current 25 times as readily as air. After overcoming immense difficulties, Professor Kammerlingh Onnes, of the University of Leyden, in 1908, succeeded in liquefying helium. The liquid boils at -268.75° centigrade or 4¼° absolute. Solid helium has not yet been obtained.

The French and British had no dirigibles at the beginning of the war, but later hastened to repair their deficiency. From experience gained in the defense of London and other important points, it was recognized that the dirigible was vulnerable—extremely so, against a well-organized attack. The inflammability of the hydrogen contained in the ship was the one weak point in this method of attack. The remedy for this situation was, of course, to be found in a non-inflammable gas, light enough to replace hydrogen as a lifting force; helium is the only gas known to have these qualities. The use of helium has still other advantages: It diffuses through a fabric at about three-quarters the rate of hydrogen; its non-inflammability makes it possible to place the engines in the framework of the dirigible, thus getting a direct drive, giving greater control of the craft, and much increased speed for any given horsepower.

Early in 1915, word came to an official of the Bureau of Mines that the British were interested in sources of helium for use in dirigibles. When the United States entered the war in 1917, helium for use in dirigibles was discussed among Bureau of Mines' officials, and in June the matter was presented to the Army and Navy Air Services as a war project. These services enthusiastically approved the proposition, and allotments of money were made from the Army and Navy appropriations to carry it forward.

Three experimental plants were constructed in Texas, under the direction of the Bureau of Mines, two at Fort Worth, for economic reasons; one plant used the Linde system of liquefaction, the other the Claude system, and the supply of gas was piped to the plants from Petrolia, Texas. Analysis had shown that this gas contained 95% helium. Another plant was later constructed at Petrolia, near the gas wells, and use was made of a new method of liquefaction, called the Jefferies-Norton process. All three plants produced helium, but the Linde plant proved the most efficient, and it was decided to construct, under the cognizance of the Navy, a much enlarged plant for obtaining helium in greater quantities. The construction of this plant was started in October, 1918; it was completed in December, 1920, and was operated during part of 1921. It produced altogether about 2,000,000 cubic feet of helium, which, with the helium obtained at the smaller plants during the experimental period, makes available at the present time a total of about 2,400,000 cubic feet of helium over 90% in purity. Most of the gas is around 95% grade.

Before the completion of the large plant, the two experimental plants at Fort Worth were shut down and dismantled. The plant at Petrolia, Texas, was continued, however, until July, 1921, on a purely experimental

basis. It was then shut down, and at the present time is being kept in a standby condition.

The method of operation in all of these plants is, in general, the same, although there is considerable difference in detail. The object is to liquefy all of the elements making up the natural gas except the helium, which does not liquefy at the temperature used. After liquefaction of all other constituents in the gas—such as nitrogen, methane, ethane, propane, and butane—the helium can be pumped off. Thus far, helium has been obtained in two stages. One stage in operation gives about 70% purity; this has been refined up to 95%. In the second operation the nitrogen, representing practically all the impurity, is liquefied and the helium is once more pumped off.

No production of helium is now in progress, but funds will probably be furnished by Congress to run the large plant at Forth Worth practically during the whole of next year. Under such conditions, from eight to ten million cubic feet of helium may be obtained.

Two helium repurification plants have been constructed by the Army, and the Bureau of Mines is co-operating in installing the final liquefaction equipment. One of these is at Langley Field, Va. In this is used an expansion engine refrigeration system, with heat interchanges, and an especially designed purifier. This plant will be used for refining helium after it has been used in a balloon or dirigible and has become contaminated with air by interchange through the fabric. When the grade of the gas is reduced to 85%, its lifting power (which is normally 92% that of hydrogen when both gases are 100% pure) is too low for practical use, and the gas must be refined. After being refined, it can be used again.

The other repurification unit has been installed on two railroad cars. One car contains the power plant, and the other the compressors and liquefaction equipment. These can be moved from place to place as needed. The use of charcoal at low temperatures for repurification will be tried in this plant. Charcoal exercises selective action in absorbing air and nitrogen, taking them up freely, whereas helium is scarcely absorbed at all. In this way a separation of helium can be obtained.

Complete equipment for conducting research at low temperatures, the Cryogenic Laboratory of the Bureau of Mines, is located at Washington in the Interior Department building, representing the research department of the whole helium project, and employing a force of 12 men. Fundamental information is being obtained that is essential for the construction of any new plant designed to have greater efficiency than the large plant at Fort Worth. Helium can probably be produced in this plant for ten cents a cubic foot, but it is believed that the cost can, ultimately, be reduced to 3 cents and perhaps to 2 cents. Necessary information is being gradually accumulated to this end.

The Government's entire helium program is now carried on under the general authority of the Army and Navy Helium Board, consisting of a representative, each, of the Army and Navy, together with a delegate from the Bureau of Mines.—*Reports of Investigations,* U. S. Bureau of Mines.

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NOTES ON INTERNATIONAL AFFAIRS

FROM AUGUST 5 TO SEPTEMBER 5

PREPARED BY

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GERMAN REPARATIONS

NO DECISION AT LONDON.—The meeting of Allied premiers held in London during the week of August 7-14 failed to reach decision on the question of a delay in German reparations payments. The proposals for further guarantees made by France, including control of German mines and forests and a customs barrier between the occupied territory and the rest of Germany, were disapproved by a committee of experts by a vote of 4 to 1. Without such guarantees Premier Poincaré refused to consent to a moratorium.

REPARATION COMMISSION GRANTS DELAY.—Upon the failure of the London Conference, the question of delayed payments went back to the Reparation Commission. The latter first sent the British and French Commissioners to Berlin for further study of German finances, and then in session in Paris on August 27 called upon Germany for further proposals. Germany offered guaranteed increased deliveries of coal and timber in lieu of cash payments.

Finally on August 31 the Commission announced a decision, based on Belgium's compromise proposals, by which Germany was released from further payments, amounting to about 250,000,000 gold marks, for 1922. Belgium, with priority claims for this amount, agreed to accept six months' Treasury bills instead. The decision regarding a further moratorium was held up pending reforms in German finances. Up to the last France threatened independent action against Germany, Premier Poincaré consenting to the commission's decision only upon realization that an independent course on the part of France would destroy Allied solidarity and virtually tear up the Versailles Treaty. The text of the decision follows:

The Reparation Commission, after examining the new request for a moratorium, dated July 12, 1922, and taking into account the fact that the German State has lost its credit, both internal and external, and that the mark has depreciated continuously down to three one-thousandth of its normal value, decides:

Firstly—to defer its decision on the request of the German Government until the Commission has completed its scheme for the radical reform of German public finances, including:

(a) Balancing of the budget;
(b) In the event of the Governments represented on the Reparation Commission giving their prior consent thereto, reduction of Germany's foreign obligations insofar as may be considered necessary for the restoration of her credit;
(c) Currency reform;
(d) The issue of foreign and internal loans in order to consolidate the financial situation.

Secondly—With a view to giving time for reparations and the carrying out of the measures referred to under paragraph 1 above, the commission agrees to accept in payment of the cash installments falling due August 15 and September 15, and, unless in the meantime other arrangements are made, of the further cash installments falling due between October 15 and December 31, 1922, German Government six months' Treasury bills, payable in gold and guaranteed in such manner as may be agreed upon between the German Government and the Government of Belgium (to which Power the payments have been assigned), or, in default of such agreement, by the deposit of gold in a foreign bank approved by Belgium.

PRE-WAR DEBT PAYMENTS.—On August 18 a joint Allied note was sent to the German Government stating the decision of Allied experts regarding payments by Germany on pre-war debts owed by German nationals to Allied nationals. The decision was that Germany must pay within one month the £2,000,000 due on August 15, but that thereafter the various Governments should make separate arrangements with Germany subject to the approval of the Reparation Commission.

On August 27 it was reported that a settlement with France was in prospect, and that the French reprisal measures against Germans in Alsace would be suspended.

FRENCH DEBT MISSION TO AMERICA RECALLED.—On August 17 Premier Poincaré ordered the French Debt Commission in the United States, headed by M. Jean V. Parmentier, to return to Paris. M. Parmentier was empowered only to lay the French financial situation before the U. S. Refunding Commission, and apparently also to show that France could not pay her debt to America unless Germany fulfilled her obligations to France. The recall, however, was not regarded as an interruption in negotiations, which would be renewed after further decision in the matter of German payments.

GERMAN-AMERICAN CLAIMS SETTLEMENT. Washington, August 10.—The signing in Berlin today of an agreement between representatives of the United States and Germany for the determination of the amount of American claims against Germany was announced this evening by Secretary Hughes.

The agreement provides for a mixed claims commission of two commissioners, one to be named by the United States and the other by the German Government with an umpire to settle matters on which the commissioners cannot agree.

President Harding today named William R. Day, Associate Justice of the United State Supreme Court as umpire acting upon the expressed desire to have an American citizen appointed.

There appears to be no intention on the part of the Administration to make the operation of the agreement contingent upon ratification by the Senate. The agreement, in fact, itself provides that it shall "come into force on the date of its signature."

The commissioners meet at Washington within two months after the coming into force of the agreement.

IRELAND

DEATH OF IRISH LEADER.—Arthur Griffith, founder of the Sinn Fein movement, president of the Dail Eireann Cabinet, and leader of the Free State party in Ireland, died on August 12 from the effects of a slight operation for tonsillitis aggravated by a general breakdown in health. Griffith's death was a serious loss to the cause of the Free State and the Anglo-Irish Treaty. He was buried on August 16 in Glasnevin Cemetery, the burial place of Daniel O'Connell and other Irish patriots.

Ten days after Griffith's death, on August 22, Michael Collins was killed in an attack upon his party by rebel forces near Cork. Collins had left Cork and was proceeding southward to inspect military positions when his party in automobiles was ambushed. Collins was commander-in-chief of the National Irish Army, finance minister in the Dail Eireann Cabinet, and after Griffith's death head of the Irish State. Upon Collins' death William T. Cosgrave, who with Collins and Griffith was one of the signers of the Anglo-Irish Treaty, became head of the Government until the meeting of the Dail Eireann Parliament on September 9. Richard Mulcahy was made commander-in-chief of the Free State army.

During August the republican forces in Ireland were driven from Cork and other strongholds and almost reduced to guerilla warfare. With the capture of Waterville on the Kerry coast, on September 3, five of the cables which for three weeks had been held by the rebels, were released.

AUSTRIA

GOVERNMENT SEEKS FOREIGN SUPPORT.—The Austrian government at the close of August undertook a policy of sounding her territorial neighbors with a view to economic assistance, Chancellor Seipel in turn visited Prague, Berlin, and Rome with a warning that Austria's collapse was at hand and that parts of her territory were likely to break away or be seized by other states unless support were forthcoming.

There were reports of economic alliance between Austria and the Little Entente, and on the other hand of an understanding between Italy and Austria. Italy indicated that she was unalterably opposed to any union of Austria and other Danube states, in accordance with the French policy of building up a Central European Confederation against Germany. Such a confederation, with Jugo-Slavia included, would also be anti-Italian. In a note to the powers, Italy stated that Austria's union with Germany or entry into the Little Entente would be regarded as a *casus belli*.

Austria's difficulties will come before the League of Nations Assembly in September. At a meeting of the League Council on August 31, it was decided that a report by a finance committee would be necessary before a decision could be taken in the matter of lending aid.

RUSSIA

MILITARY CLAUSES IN RUSSO-GERMAN TREATY.—From Constantinople on August 21 came a report of the revelation of military clauses in the Russo-German Treaty of Rapallo, despite the denials of the Russian and German foreign offices. The report cites a document issued by Karl Radek outlining five concessions to Germans in the Ukraine and Caucasus, involving extensive colonization by German reservists. These concessions, according to Radek, are recompense for "Germany's vast military and economic aid, which we already begin to receive."

PROPOSED AMERICAN COMMISSION TO RUSSIA.—The U. S. State Department on August 30 announced that through Ambassador Houghton at Berlin informal inquiries had been made as to the attitude of the Soviet authorities should the United States consider sending an expert technical commission to study the economic situation in Russia.

Nothing was done in the matter after the Russian reply. This was in effect that the commission would be received only on a reciprocal basis, i. e., on condition that Russia be allowed to send a commission to America.

NEAR EAST

ENVER PASHA REPORTED SLAIN.—According to a Moscow despatch of August 16, Enver Pasha was killed in Bokhara on August 4 in a cavalry attack on Soviet troops.

Enver Pasha was one of the leaders of the young Turks who dethroned Abdul Hamid. He was chief of staff of the Turkish Army in 1913-14 and chiefly blamed for Turkey's entry into the war on the side of Germany. After the war Enver fled from Turkey and was engaged in intrigues with the Soviets, who later accused him of treachery. His last effort was to become Emir of Turkestan.

TURCO GREEK PEACE PROPOSALS.—London, August 21.—A joint invitation will, it is expected, be dispatched in ten days or a fortnight by Great Britain, France, and Italy to Greece and both Constantinople and Angora Turks to attend the conference to be held at Venice on the Near Eastern situation. The conference was suggested by the three Allied High Commissioners at Constantinople, Sir Horace Rumbold, General Vellé and Maruis Garroni, and has been agreed to by the Allied Governments.

The object of the conference is not to make definite peace, but to propose ground for a full-fledged peace conference. The Allies will insist that a declaration of armistice shall be one of the conditions imposed and will not listen to the Angora demand for the evacuation of Asia Minor by the Greeks before the conference comes together.

The basis of the conference will be proposals for a settlement of the Near East situation made in March by the allied foreign Ministers at Paris. These included the retirement of Greece from Smyrna, the with-

drawal of the allied troops from Constantinople to the Gallipoli Peninsula, and the demilitarization of zones between European Turkey and Grecian Thrace along the southern shore of the Dardanelles.

Representatives of the International Red Cross, which is to inquire into the alleged massacres of Greeks in Asia Minor, arrived at Constantinople last week and are now awaiting word from Angora as to how far they will be permitted to go in making their investigations. The question of who is to provide the funds for their expenses has also been raised.—*New York Times.*

RENEWED TURKISH OFFENSIVE.—On August 4, the Greek Government in a note agreed to relinquish its designs against Constantinople in view of the attitude of the Allied powers.

While the Greek forces were weakened by the concentration in Thrace, the Turkish Nationalists on August 27 took the offensive in Asia Minor, and on that date captured Afium Karahissar, an important strategic point at the junction of the Smyrna branch and the main line of the Bagdad railway.

FAR EAST

UNION OF PEKING AND CANTON LEADERS.—On August 10 Sun Yat-sen, after the defeat of his forces by General Chen-Chiung-ming, left his cruiser in Canton Harbor and went to Shanghai aboard a British gunboat. Subsequently it was reported that Sun was in friendly negotiations with President Li Yuan-hung in Peking and would probably go north in person. General Wu Pei-fu, chief sponsor of the northern government, on August 21 endorsed Sun's proposals for a parliament free from outside influences, self-government of the provinces in place of the Tuchun or military governorship system, and conversion of the provincial armies into labor battalions.

In the meantime the Peking Government was reported in serious difficulties owing to the defiance of military leaders, lack of funds to pay civil employees and army, dissension in parliament between northern and southern groups, and renewed operations of the Manchurian rebels under General Chang Tso-lin.

UNITED STATES AND LATIN AMERICA

SECRETARY HUGHES AT BRAZIL CENTENNIAL.—Secretary of State Hughes sailed from New York on August 25 as head of the special American mission to the Brazil Centennial celebration at Rio de Janeiro. Secretary Hughes' visit recalled the coming of Emperor Don Pedro of Brazil to America at the time of the American Centennial in 1876.

INTERNATIONAL PROBLEMS

RATIFICATION OF ARMS TREATIES. London, August 1.—Formal ratification of the Washington armament treaties by Great Britain was completed today and copies of them signed by King George will be sent to Sir Auckland Geddes at Washington in the diplomatic bag by the next steamship.

The ratification has taken some months because it was necessary to obtain the formal assent of the Dominion governments and action by the Dominion parliaments to make the terms of the agreements effective.

Tokio, August 10 (Associated Press).—As soon as ratifications of the Washington Arms Conference are exchanged by the United States, Great Britain, and Japan, the Japanese Admiralty will put into effect plans already made for scrapping war tonnage under the naval limitation program.

An Admiralty official explained that until these three powers took final action, Japan did not feel justified in scrapping a single new ship. He said, however, that Japan was uninfluenced by what France might be disposed to do.

A strong party here would favor making the five-power treaty a three-power one should France and Italy fail to ratify.

Washington, August 10 (Associated Press).—Although officials of the Washington Government are anxious that the Naval Limitation Treaty shall come into force at the earliest practicable moment, they have made no plans for an exchange of ratification until all five of the signatory powers are ready to record formal approval.

To await action by France and Italy, as well as by Japan and Great Britain, it is pointed out, not only would be in accord with the earnest desire here for consummation of the naval program laid down by the Washington Conference at the instance of the United States.

Should Japan formally suggest an earlier exchange of ratifications by the three powers which are principals in the 5-5-3 arrangement, it is indicated that the proposal would receive careful consideration by State and Navy Department officials. In that connection it is recalled that the American, British, and Japanese delegations to the conference agreed that the 5-5-3 ratio should stand as applying to the three powers regardless of the policies of France and Italy, and it is not doubted that a three-power treaty on the subject would be possible should permanent obstacles block ratification of the five-power arrangement by France or Italy.—*New York Times*, November 8.

MEETING OF LEAGUE OF NATIONS ASSEMBLY. Geneva, August 18 (Associated Press).—South America probably will play the leading rôle at the third assembly of the League of Nations, which opens here on September 4, in consequence of the numbers of questions of world-wide importance which have been placed before the League by the South American members.

A formal application from Hungary for membership in the League has been received and will be acted on at the September meeting.

Among the questions which South American members have placed before the League are Uruguay's proposals for an American League of Nations within the League, the extension of the Washington naval accord to all other naval powers, which would include a number of South American powers, and the relation of the forthcoming Santiago (Chile) conference to the League and its plan for world disarmament.

So important a place does South America occupy on the program of the third assembly that a movement has been started to elect a South American president of the body. Augustin Edwards, Chilean minister to Great Britain, who took such a prominent part in the last assembly, is prominently mentioned for the post.

CONTROL OF CABLES. Williamstown, Mass., August 15.—The Institute of Politics centered its interest today on the discussion at the Round

Table on International Electrical Communications Service, where Walter S. Rogers, American delegate to the International Communications Conference in 1920, reminded the institute of other post-war problems, still unsettled, in which the American viewpoint had encountered an obstinate resistance.

It was not till America entered the war, according to Mr. Rogers, that Great Britain diverted the German cable hitherto connecting the Azores with New York so that it now runs into Halifax and forms a part of the "British All-Red Cable Route" to the Pacific. The American peace envoys, he said, contended in vain that this was a diversion and interference, not alone with German property, but with the communications route on which the cable life of the United States depended.

In the round table conference Great Britain's practical domination of the world cable routes was shown, as well as the total lack of an independent cable system belonging to America.

Mr. Rogers discussed the political, commercial and military significance of telegraphs, cables, and radio, and some of the national and commercial rivalries growing out of efforts to obtain and control monopolies. He traced the maneuvers which long delayed the efforts of the Germans to utilize the Azores as a relay station for cables to the United States. Referring to the pre-war interruption to cables touching Ireland, he urged the necessity for more cables between the United States and the Azores as an alternative route and as freeing the United States from dependence upon Great Britain for cable landings.

Would Have the Azores Free

"While the British monopolistic concession at the Azores had expired," said Mr. Rogers, "the Portuguese Government hesitates to grant landing rights to American companies, probably because of influence brought to bear by the British cable companies, who look askance at the United States gaining greater cable freedom. In order to permit a wide extension of American cable contacts every effort should be made to make the Azores easily available and free from possible interference by foreign companies or third governments for cable relay purposes, the Azores being ideally located for becoming a great cable center, with cables radiating to various places in Europe, Africa, South and North America.

"The Azores should virtually be internationalized as a cable center and the powers by treaty obligated, even in time of war, not to seize control of the cables landed there. Portugal would gain through the interesting of other powers in maintaining the political *status quo* of the islands, and because the commerce of the Azores would be aided and tax receipts increased."

At the outset of the war, Mr. Rogers said, Germany had the best radio system and Great Britain the best cable system because of the virtual British world domination. He indicated how this had been built up in detail, and attributed British control largely to the fact that all cables always had been made in Great Britain and sold "laid," as he termed it. In this way the British Admiralty had been able to get full information as to the location of cables all over the world."

In showing the dexterity of the laying of cables with a view to their possible interruption in war, he said that sometimes dummy cables are laid, as, for instance, was the case in the Indian Ocean, where the Germans had cut a cable and no interruption was accomplished. It was the British policy, Mr. Rogers said, to develop cables only that would touch British points. He explained the great centering of cables in London and attributed London commercial supremacy largely to that fact.

Mr. Rogers then went into a discussion of the commercial advantages of cables. He instanced the indispensability to shipping of good cable

communications, although ships now were more directly dependent on radio. But always in freighter service, he said, a captain would go to some port and discharge his cargo and await cable instructions, and possibly not return to England for several years. The political importance of electrical services he showed particularly by explaining the links of such services that connected up the entire British Empire.

Commenting on Mr. Rogers' remarks at the Institute of Politics, President Carlton of the Western Union Telegraph Company declared that inadequate American cable communications were due to slow action by the Government. "Apparently Mr. Rogers thinks there is no United States cable policy," said Mr. Carlton. "If he means no government policy, I cordially agree. Whether Mr. Rogers is speaking as an individual or as an employee of the State Department, he knows that the Western Union Telegraph Company has been applying for more than a year for permission to extend its cable system to Northern and Southern Europe, South America, Japan and China.

"So far, and despite almost daily efforts on our part, the State Department has failed to act. Mr. Rogers should know that in 1918 a comprehensive plan of cable extensions was laid before the Government and urged upon Congress. This plan, in brief, contemplated cables to Northern Europe, Southern Europe, Russia, Japan, China and the east and west coasts of South America.

"The plan also proposed a more effective distribution of the present concentrated cable facilities now terminating in Great Britain. Mr. Rogers is apparently unaware of this program. It can be fairly said that before Mr. Rogers can effectively develop interest in what he has called a United States cable program, it will be necessary for him to agitate revision of the procedure of his own, the State Department. Cable expansions can only be made by encouraging private enterprise.

"Private enterprise is not encouraged if the machinery of government is ineffective, slow and unbusinesslike, resulting in a year's delay in obtaining the simple right to land and operate a cable about which there is no dispute.

"Mr. Rogers says the British are pre-eminent in the cable business. They are, and it is interesting to contrast the methods that prevail in Great Britain in dealing with cable extension and the methods that prevail in this country. Recently we had occasion to apply to the British Government for right to land a cable. Within twenty-four hours we had the right. Recently we also applied to the Canadian Government for a right to land three cables. This was granted within a few hours. Mr. Roger's department has been considering our applications for cable landings since June, 1921, and we have not heard yet what they are going to do.

"In fine, it is idle to talk about expanding cables or a cable plan so long as the companies are subjected to the delays of the State Department under the operation of the Kellogg act."—*New York Times*, December 8.

REVIEW OF BOOKS

THE LITERATURE OF PEACE, by Col. S. C. Vestal, C. A. C.

If the vagrant will of the Nations' Man has been chained by the League of Nations and the Washington Conference for the Limitation of Armaments, we are at the beginning of a great new world epoch and Vestal's *Maintenance of Peace* is justified.

As that interesting volume has played an important part in shaping diplomatic thought toward the great ends achieved, it is interesting to compare the author's deductions from political and military history with the actualities as they appear to be unfolding before us in the march of world events.

But, first, let us recall the identity of the author.

In 1895, Samuel C. Vestal was graduated, high in his class, from the U. S. Naval Academy. Shortly thereafter he resigned from the navy and enlisted as a private in the army. In those days it was a long, tedious road from private to subaltern, but it was the ideal way, under the circumstances, for, after having been an officer, he could fully appreciate the side lights of the enlisted point of view. Vestal had the courage and patient determination to follow that course. He is a colonel in the army now and a member of the faculty of the Army War College, the apex of the United States military educational system. Besides a wealth of experience as a practical soldier, including the command of a field artillery regiment in France during the World War, he has been a relentless student of history for a quarter of a century.

Thus he estimates his problem of peace from several excellent points of view: from that of the sailor educated by way of the refined academic route; from that of the soldier educated by way of the hard knocks of actual service; from that of the student of history and of the science of war; from that of an important participant in a great modern international conflict.

If the *Maintenance of Peace* is destined to become a classic, it will carry with it down through the centuries of posterity some twenty of the author's hard-working years devoted to its preparation.

Colonel Vestal takes the problem of peace as he would take any real problem and estimates its possibilities as a problem in power, quoting Pascal's, "You must combine justice and power, making what is just strong, and what is strong just."

He maintains, and proves by historical precedent, that even if states could be assured of immunity from foreign aggression it still would be necessary to support large armaments. "The existence of domestic peace in any country," he says, "is due to the fact that men interested in the

welfare of the country have the means to enforce order at any moment that it may be disturbed."

Increase of armed forces always has been necessary after revolutions to meet counter-revolutions. Examples: Cromwell's unexcelled army followed the few household troops of Charles I; the vast armies of the Republic, Consulate, and Empire, followed the small army of Louis XVI; the great republican army of Yuan-Ski-Kai after the inefficient army of the Manchus. The United States needed an army of nearly a million men and a navy of six hundred vessels to restore domestic tranquility.

"There is an innate desire in the hearts of every people to extend its frontiers to the limits of the island or continent or habitable district which it occupies, in order to extend its area of domestic peace and put an end to foreign wars."

The maintenance of the balance of power in its widest concept is the author's certain guaranty of world peace.

"The joint resistance of several nations to Caesarism, or the domination of a single nation, is designated as the maintenance of the balance of power." A desirable status of balance of power does not imply, it is explained, an equipoise in power but rather a preponderance. An equipoise, such as existed between the European Triple Alliance and the Triple Entente, increased the hazard. The perfection of balance of power is found in the American Union whereby the several states are so adequately guaranteed against attack by any other state.

"Superior military preparation on the part of the many who desire peace, coupled with willingness to fight, if necessary, is the only means yet devised to avoid the horrors of war."

Peace can be maintained only through maintenance of the balance of power, and the balance of power can be secured only by preparation for the fight.

If the balance of power is ever overthrown on the European-Asiatic continent, the rest of the world will wear the chains of servitude to the successful world conqueror.

The important observation, not previously appreciated by military students nor sufficiently emphasized by military writers, is made that the modern world has been saved from the domination of the single nation by the fortunate fact that the strongest military state never has been at the same time the strongest naval power; i. e., because the command of the land and command of the sea never have been in one nation at the same time. No nation can establish universal rule until it achieves a great conquering army and a fleet powerful enough to dispute seriously the command of the sea. Sea power has been the salvation of the weaker states as against powerful military neighbors.

In this connection it is urged as most important that sea power never should be emasculated by *exempting private property from capture at sea.*

The maintenance of the balance of power is shown clearly to be the policy of mutual guaranty of territorial integrity and independence. Therein, the author believes, lies the only hope of peace—at best a

voluntary union of free commonwealths whose continued existence has a shadowy, uncertain guaranty. A definite union of independent states to preserve peace would amount to either federation or confederation. Federation would mean a world power wherein the central control would legislate for the individuals of the nations of the world, or a world tyranny such as Germany recently sought to impose. Confederation, on the other hand, has been demonstrated as ineffective government because such central control has to legislate for states over which it has no power (other than the pressure of war) to impose its decrees. In a federation or confederation of nations, who is to solve the problem of establishing a legislative body to represent, on an equitable basis, the people who are to pay the taxes? (The reader is impressed with the practical character of the book.) Federation of the British Empire would be simple compared with the federation of Europe; the federation of Europe would be *simplissimo* compared with the federation of the world. Are we ready to pass the strings of our rich purse to the tax-collector of Bokhara?

Colonel Vestal pays his respects to the international court as a means of settling political disputes. The analogy between such a court at the Hague and the United States Supreme Court, which decides suits between states of the United States, is challenged. In the one case, the issues are political; in the other, they are legal. Political issues, within the United States, come solely within executive and legislative jurisdiction. "It is the fixed unwillingness of men to settle political questions by judicial means" that always would defeat reliance upon universal arbitration. The most notorious of the few incidents of attempts of the United States Supreme Court to decide political questions was the *Dred Scott* case—in which the executive and legislative departments of the government disregarded the decision.

Aside from the force and eloquence of the author's scholarly protagonism for his thesis, this interesting volume commands especial attention for its magnificent review of military history—real history, for it not only makes an illuminating recital of the event but it applies the result of the issue of events to the march of life. We have the fascinating stories of Assyrian and Babylonian war lords committing their wild atrocities in the Euphrates valley during the second milennium B. C. We find Nebuchadnezzar mixed in pleasantly with the first example of the effective operation of the balance of power in 585 B. C. at the Battle of the Eclipse when he reconciles Cyaxares, king of Media, and Alyattes, king of Lydia, by proposing an international marriage intended to create binding ties amongst the three great powers of western Asia. There is an excellent précis of the integration of the Inca Empire whereby one fancies he sees the fifteenth century prototype of the German war machine of 1914. Persian and Macedonian epochs are given due notice. Roman strategic events are especially illustrative in the author's thesis. Even the greatest, if little known, sea fight, the Battle of Ecnomus, 256 B. C., is not overlooked.

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Charlemagne was the first modern to upset the balance of power. Since his time, there have been periodical efforts: Spain, France, Russia, Sweden, in turn have overrun the continent while isolated England has aligned herself against the assailants of the balance.

But this manly book of honest courage, sparkling with the selected gems of some sixty centuries of fighting, has a great defect. Colonel Vestal adopts the historical method to discuss the world's peace. Then he entirely ignores the military history of a large part of the world—a part that is of particular interest to the peace of the twentieth century—Asia. Certainly the tremendous military events of the twelfth and thirteenth centuries, when Tartar armies raced across Asia north and south, east and west, in fiendish exploits, unchecked by scarcely a single defeat in the quarter of century of their greatest activity, must carry a lesson or two with respect to the maintenance of peace. If nothing more, it suggests that an obscure Mongolian tribesman with no following could rise, gain power, and conquer almost the entire known world. Why, then, should not some other leader appear for a Yellow host of fifty million men? And, as for the balance of power, what was the nature of the many dealings of the Great Mongol with the numerous nations that he controlled? In the same way, Colonel Vestal has disdained the Russo-Japanese War and the Chinese-Japanese War of 1895.

These are important omissions—fatal to the logic of the thesis. The American reader particularly would wish for the author's analysis of Oriental strategy in its bearing upon the American view of Pan-Pacific situations. Mr. Roosevelt advised that "a full knowledge of the history of the Mongol people is imperatively necessary to all who would understand the development of Asia and of Eastern Europe."

Colonel Vestal must amend his great book in its next edition so as to bring Asia within the scope of his logic.

The *Maintenance of Peace* is, perhaps, or may be recognized (when the substance of the solution or fluid state of international relations becomes precipitated) as the *Uncle Tom's Cabin* of peace-producing literature. It certainly stands out conspicuously among the greatest of military publications: Mahan, Clausewitz, Corbett, von der Goltz, etc. While it is compact with information that ought to be in the heads of good citizens, and certainly in the heads of men of the fighting professions, it is delightfully interesting in every page.

During the past thirty-four centuries there have been about 8,000 recorded wars, duly concluded by treaties of peace. In every century there have been ninety-three years of war and only seven years of quiet, as an average. If this old monster of the cartoonist's fancy is really dead, we must be interested in this book that is so close akin to the requiem for the "late lamented."